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SOME EFFECTS OF IRRADIATION ON METALS, by W. E. Parkins. Issued Jan. 28, 1952. Decl. with deletions May 15, 1952. 27p. (AECD-3372; NAA-SR-MEMO-205)

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FISSION ASYMMETRY AS A FUNCTION OF EXCITATION ENERGY OF THE COMPOUND NUCLEUS, by J. L. Fowler, W. H. Jones and J. H. Paehler. [nd] Decl. May 19, 1952. 4p. (AECD-3374)

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PRELIMINARY DATA ON THE PHASE EQUILIBRIUM SYSTEMS UO_2-MgO; U_3O_8-MgO; $UO_2-Nd_2O_3$; $U_3O_8-Nd_2O_3$; AND $UO_2-Al_2O_3$, by Wingate A. Lambertson and Melvin H. Mueller. Apr. 8, 1952. Decl. Apr. 22, 1952. 43p. (AECD-3376; ANL-HDY-704)

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ENERGY DISTRIBUTIONS OF FRAGMENTS FROM THE FISSION OF U^{235}, U^{238}, AND Pu^{239} BY FAST NEUTRONS (thesis), by John S. Wahl. Los Alamos Scientific Lab. and Iowa State Univ. [nd] Decl. Apr. 29, 1952. 90p. (AECD-3379; LADC-1143)

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RaD PURIFICATION, Po PREPARATION, AND CALIBRATION OF MEASURING APPARATUS, by R. J. Prestwood. Jan. 21, 1944. Decl. May 19, 1952. 13p. (AECD-3380; LADC-293)

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DETERMINATION OF RADIUM IN RESIDUES; DISSOLUTION OF THE SAMPLE IN CONDENSED PHOSPHORIC ACIDS, by C. A. Wamser, E. Bernsohn, R. A. Keeler and J. Onacki. [nd] Decl. May 19, 1952. 8p. (AECD-3381; KLX-23-75-N)

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THE DISSOCIATION OF ETHYL BROMIDE AND IODIDE BY NEUTRON CAPTURE, by Sol Wexler and T. H. Davies. Argonne National Lab. and Institute for Nuclear Studies, Univ. of Chicago. Apr. 1952. 27p. (AECU-2017; UAC-557)

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STUDIES ON THE MECHANISM OF ACTION OF IONIZING RADIATIONS; X. EFFECT OF HYDROGEN PEROXIDE ON CELL METABOLISM, ENZYMES, AND PROTEINS, by E. S. Guzman Barron, Louise Seki, and Phyllis Johnson. Mar. 1952. (AECU-2018; UAC-561)

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THE SCATTERING OF 10-MEV DEUTERONS BY H^3 AND He^3, by A. H. Armstrong, J. C. Allred, A. M. Hudson, R. M. Potter, E. S. Robinson, L. Rosen, and E. J. Stovall, Jr. [nd] 5p. (AECU-2024; LADC-1119)

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TITRATION OF PHENOLS IN NONAQUEOUS SOLVENTS, by James S. Fritz and Robert T. Keen. Ames Lab. and Keystone Oil Refining Co. [nd] 14p. (AECU-2029)

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THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS; PROGRESS REPORT FOR DECEMBER 1 TO FEBRUARY 29, 1952, by T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, R. Bakish, J. Intrater and M. Wechsler. [nd] 6p. (NYO-935)

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INTERNAL CONVERSION IN Cu^{64} AND Fe^{59}, by D. Brower, George W. Hinman, G. Lang, R. Leamer and D. Rose. Apr. 14, 1952. 6p. (NYO-3301)

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TURBULENCE STUDIES USEFUL IN WIND TUNNEL SIMULATION OF ATMOSPHERIC CONDITIONS; PROGRESS REPORT, METEOROLOGICAL PHASE, JULY 1, 1950 TO FEBRUARY 28, 1951, by Hans A. Panofsky and Irving A. Singer. Feb. 28, 1951. 75p. (NYO-4001)

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DEVELOPMENT OF CONTROLS FOR PRODUCTION OF TEMPERATURE AND VELOCITY GRADIENTS IN THE WIND TUNNEL; PROGRESS REPORT WIND TUNNEL PHASE, by J. A. Halitsky, C. P. Randell and M. Hackman. Apr. 9, 1951. 90p. (NYO-4002)

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BIOCHEMICAL STUDIES IN CHRONIC MYELOCYTIC LEUKEMIA, POLYCYTHEMIA VERA, AND OTHER IDIOPATHIC MYELOPROLIFERATIVE DISORDERS, by William N. Valentine, William S. Beck, James H. Follette, Harold Mills and John S. Lawrence. Issued Apr. 28, 1952. 53p. (UCLA-197)

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THE DETERMINATION OF SUB-MICROGRAM QUANTITIES OF ARSENIC BY RADIOACTIVATION. PART III. THE DETERMINATION OF ARSENIC IN BIOLOGICAL MATERIAL, by A. A. Smales and B. D. Pate. Feb. 6, 1952. 18p. (AERE-C/R-859/3)

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METHOD OF CONCENTRATING KEROGEN IN COLORADO OIL SHALE BY TREATMENT WITH ACETIC ACID AND GRAVITY SEPARATION, by Arnold B. Hubbard, H. N. Smith, H. H. Heady, and W. E. Robinson. Apr. 1952. 17p. (BM-RI-4872)

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SURVEY OF PORTIONS OF THE CHROMIUM-COBALT-NICKEL-MOLYBDENUM QUATERNARY SYSTEM AT 1200°C, by Sheldon Paul Rideout and Paul A. Beck. Apr. 1952. 81p. (NACA-TN-2683)

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A FUNDAMENTAL STUDY OF THE MECHANISM BY WHICH HYDROGEN ENTERS METALS DURING CHEMICAL AND ELECTROCHEMICAL PROCESSING, by L. D. McGraw, C. A. Snavely, H. L. Moore, P. T. Woodberry and C. L. Faust. Apr. 1952. 43p. (NACA-TN-2696)

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QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION; FOR THE QUARTER ENDING JUNE 30, 1951. 37p. (NBS-1080; U18947)

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COLLOIDAL VIBRATION POTENTIALS, by Ernest Yeager, Harry Dietrick, and Frank Hovorka. Apr. 1, 1952. 42p. (NP-3776; Technical Report No. 7)

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NP-3798 3739
Pitman-Dunn Labs., Frankford Arsenal
BIOLOGICAL EFFECTS OF IONIZING RADIATIONS FROM RADIUM AND POLONIUM ON FUNGI. PART III. THE PREVENTION OF MOLD GROWTH IN OPTICAL INSTRUMENTS SERIES, by Sigmund Berk. July 1951. 89p. (NP-3798; FA Report R-1016)

NP-3802 3819
Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
FAST NEUTRON SPECTROMETER PROJECT REPORT NO. 1; THE THEORY OF FAST NEUTRON COINCIDENCE SPECTROMETERS, by George E. Owen, John H. Neiler, and John C. Wheatley. June 1951. 53p. (NP-3802; Report No. 1; U18899)

NP-3805 3800*
Columbia Univ.
FINAL REPORT ON NAVY CONTRACT; JUNE 29, 1948–JUNE 28, 1949. PART A. THE APPLICATION OF THE PERRIN THEORY TO LIGHT SCATTERING PHENOMENA OBSERVED FROM SULFUR HYDROSOLS OF VARIOUS PARTICLE SIZES, by Victor K. La Mer and Milton Kerker. PART B. THE METHODS OF FORMING, DETECTING AND MEASURING THE SIZE AND CONCENTRATION OF LIQUID AEROSOLS IN THE SIZE RANGE OF 0.01 TO 0.25 MICRONS DIAMETER, by Victor K. La Mer, Edward C. Y. Inn and Irwin Wilson. [nd] 65p. (NP-3805)

NP-3806 3806
California Univ., Berkeley
CONCENTRATION POLARIZATION AND LIMITING CURRENTS; A CRITICAL REVIEW OF EXISTING THEORIES, by Morris Eisenberg, Charles W. Tobias, and Charles R. Wilke. Jan. 15, 1952. (NP-3806; Technical Report No. 1; U21894)

NP-3824 3812
Massachusetts Inst. of Tech.
PHYSICAL, BIOLOGICAL, AND ADMINISTRATIVE PROBLEMS ASSOCIATED WITH THE TRANSPORTATION OF RADIOACTIVE SUBSTANCES; NUCLEAR SCIENCE SERIES PRELIMINARY REPORT NO. 11, by Robley D. Evans. 1951. 76p. (NP-3824; Preliminary Report No. 11)

NP-3834 3820
Atomic Energy Research Establishment, Harwell, Berks (England)
MONITOR RADIATION BETA-GAMMA PORTABLE 1043 D; INSTRUCTION MANUAL ISSUE. 1 (A.E.R.E. Catalogue No. 3-7/6824). [nd] 20p. (NP-3834)

NP-3835 3807
Atomic Energy Research Establishment, Harwell, Berks (England)
HIGH RESISTOR METER TYPE 1055B; FINAL MANUAL (A.E.R.E. Catalogue No. 3-7/7993). [nd] 38p. (NP-3835)

NP-3836 3808
Atomic Energy Research Establishment, Harwell, Berks (England)
C.R.O. MONITOR TYPE 1089B; INTERIM MANUAL (A.E.R.E. Catalogue No. 3-7/8079). [nd] 19p. (NP-3836)

NP-3837 3821
Atomic Energy Research Establishment, Harwell, Berks (England)
ALPHA ASSAY EQUIPMENT 1093.B; INSTRUCTION MANUAL ISSUE 1. [nd] 80p. (NP-3837)

NP-3856 3822
Atomic Energy Research Establishment, Harwell, Berks (England)
DOSIMETERS INDIVIDUAL; QUARTZ FIBRE; NOS. 1, 2, AND 3; INSTRUCTION MANUAL ISSUE 1. [nd] 22p. (NP-3856)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 July 15, 1952 No. 13

BIOLOGY AND MEDICINE

3734

Atomic Energy Project, Univ. of Calif., Los Angeles

BIOCHEMICAL STUDIES IN CHRONIC MYELOCYTIC LEUKEMIA, POLYCYTHEMIA VERA, AND OTHER IDIOPATHIC MYELOPROLIFERATIVE DISORDERS, by William N. Valentine, William S. Beck, James H. Follette, Harold Mills and John S. Lawrence. Issued Apr. 28, 1952. 53p. (UCLA-197)

Data are presented on the biochemical patterns of leukocytes in respect to their content of glycogen, histamine, alkaline, and acid phosphatase in subjects with (1) chronic myelocytic leukemia, (2) polycythemia vera of the type with associated abnormalities of the leukocyte picture, and (3) myeloproliferative diseases thought not to be on the basis of either leukemia or polycythemia vera. Detailed case reports are presented on a number of cases with unusual features together with comments on the clinical features and biochemical studies. In the leukocytes of chronic myelocytic leukemia there has uniformly been present very low alkaline phosphatase activity, marked elevation of histamine content, and a low glycogen content. In sharp contrast in cases of polycythemia vera with leukocyte abnormalities the alkaline phosphatase of the leukocytes has been usually markedly elevated, the histamine content moderately elevated, and the glycogen content high. In the unusual idiopathic myeloproliferative diseases of unknown etiology a variety of patterns have been found suggesting the metabolic heterogenicity of this group. The problem of the various myeloproliferative diseases is reviewed. (auth)

3735

Philadelphia General Hospital, Div. of Biochemistry

INFRARED SPECTRA OF TISSUES, by Henry P. Schwarz. [nd] 14p. (AECU-2022)

Techniques and sample preparation of tissue sections are described. The results given represent a selection of data obtained on tissue sections from rabbits, rats and some human postmortem material. Infrared spectra of visceral tissues and neural tissues from different species were recorded in the region from 15 to 2.5 μ. The spectra of these tissues showed two different types of absorption bands. In the region below 8.10 μ all the tissues showed a number of more or less strong bands at almost identical locations. These bands are very similar to known vibrations found in proteins. In the region above 8.10 μ, e.g., between 8.10 and 11.0 μ, the tissue spectra showed a fingerprint pattern so characteristic for the individual organ that it was frequently possible to identify the organ from the infrared spectrum. Problems to be solved before assignment of tissue spectra can be made are considered.

3736

Johns Hopkins Univ.

PROLONGED TREATMENT OF PERNICIOUS ANEMIA WITH VITAMIN B_{12}, by C. Lockard Conley, Thomas W. Green, Robert C. Hartmann and Julius R. Krevans. [nd] 28p. (AECU-2012)

Fifty-four patients with pernicious anemia were treated with parenterally administered vitamin B_{12} for periods of 12 to 40 months. Forty-eight patients were maintained on a dosage schedule of 45 micrograms every 6 weeks. Complete clinical and hematologic remission were maintained in every case, except for the persistence in some of apparently irreversible neurologic manifestations. The neurologic disorder did not develop or increase in severity during treatment, and in many cases improved. Oral administration of 1000 to 10,000 micrograms of B_{12} to 11 patients with pernicious anemia in relapse had a prompt and striking clinical and hematopoietic effect. About one hundred times more B_{12} was required by the oral route than by parenteral administration to produce the same hematopoietic effect. When sufficient B_{12} was given to produce maximally rapid blood regeneration, neurologic improvement appeared to occur at a maximum rate. Patients treated only with vitamin B_{12} were found to have normal prothrombin times. The evidence obtained indicates that administration of vitamin B_{12} constitutes complete therapy for pernicious anemia. (auth)

AEROSOLS

3737

Bureau of Mines

CONTROL OF METALLURGICAL AND MINERAL DUSTS AND FUMES IN LOS ANGELES COUNTY, CALIFORNIA, by Glenn L. Allen, Floyd H. Viets, and Louis C. McCabe. Apr. 1952. 110p. (BM-IC-7627)

The air-pollution problem in Los Angeles is considered, and a discussion is presented of the steps taken by specific metallurgical and mineral industries to determine the nature and amount of dust and fume produced and the methods used to control their emissions at the source. The nonferrous pyrometallurgical industries, the ferrous pyrometallurgical industries, and industrial mineral dusts and fumes are discussed separately. The electrical precipitator and the baghouse are the most versatile and positive devices demonstrated industrially to date for accomplishing the necessary end. The precipitators, large and small, operated wet or dry, are the answer to some of the most difficult problems in ferrous and light metals work and industrial-mineral processing. Units as small as 10,000 cfm are in satisfactory operation. Baghouses, particularly those designed and equipped for operation at high temperature (250 to 500°F.), are producing excellent results in both ferrous and nonferrous work at costs that most industries can afford.

RADIATION EFFECTS

3738

Argonne National Lab.

STUDIES ON THE MECHANISM OF ACTION OF IONIZING RADIATIONS; X. EFFECT OF HYDROGEN PEROXIDE ON CELL METABOLISM, ENZYMES, AND PROTEINS, by E. S. Guzman Barron, Louise Seki, and Phyllis Johnson. Mar. 1952. (AECU-2018; UAC-561)

In acid solutions and in the presence of titanium sulfate, the amount of H_2O_2 formed on x-irradiation of water was strictly proportional to the x-ray dose, so that the determination of H_2O_2 could be used to check the calibration of x-ray machines. H_2O_2 formation was depressed on addition of electrolytes; on irradiation of Ringer bicarbonate the amount formed was half that found on irradiation of distilled water. Addition of protein diminished it further. This diminution is attributed to the reaction of O_2H radicals with

the solute; H_2O_2 had very little effect on a number of substances of biological importance; its effect became more pronounced on addition of Fe^{++} ions which gives OH radicals. H_2O_2 inhibited partially the metabolism of single cells. However, the inhibition occurred only with concentrations beyond those found on irradiation of biological fluid with lethal doses of x rays. It is concluded that H_2O_2 formation has negligible role in the mechanism of action of ionizing radiations on biological systems. 51 references. (auth)

3739

Pitman-Dunn Labs., Frankford Arsenal

BIOLOGICAL EFFECTS OF IONIZING RADIATIONS FROM RADIUM AND POLONIUM ON FUNGI. PART III. THE PREVENTION OF MOLD GROWTH IN OPTICAL INSTRUMENTS SERIES, by Sigmund Berk. July 1951. 89p. (NP-3798; FA Report R-1016)

Constant irradiation with various 7.5-μg sources of Ra inhibited the sporulation of Chaetomium globosum, Lenzites trabea, Aspergillus niger, A. flavus, and a species of Penicillium growing on potato-dextrose agar. There was an appreciable difference in radiosensitivity of the species. It was concluded that α particles were primarily responsible for the effects observed. The biological effects of the irradiation of dry A. niger spores with Po α particles was dependent on the dose: (a) the lowest dose showing any visible effect (114 α or 26,900 rep) interfered with the sporulation of the fungus; (b) higher doses interfered with the extent of vegetative proliferation of the fungus; (c) larger doses (1000 α or 236,000 rep) inhibited the production of a germ tube; (d) still larger doses caused abnormally swollen spores which failed to produce germ tubes, and (e) doses in excess of 25,000 α particles or 5,900,000 rep were lethal. Isolates made from A. niger cultures that had been bombarded with Ra α particles yielded a number of mutant strains. Some of the variants were characterized by dwarf and giant conidial heads, others by a short conidiophore and a powdery type of sporulation.

3740

HYPOTHESIS OF THE BIOLOGICAL ACTION OF RADIATION. Masami Kiga. Science 115, 549-50(1952) May 16.

A simple expression for the survival curve of irradiated cells is derived for the general case of n essential molecules in a cell able to survive if no more than r of the n are damaged. Each molecule is assumed damaged by one ionization. If n = 1 and r = 0 the survival curve is an exponential. For n >1 and r = 0, an exponential curve is also obtained. This case is known as multitarget, not multihit. Finally, the case n ≥2 and r = n−1 corresponds to clumping, and a sigmoid curve is obtained.

RADIATION HAZARDS AND PROTECTION

3741

PROTECTIVE MEASURES FOR RADIOACTIVE ISOTOPES. V. E. Pullin. Engineer 193, 660-2(1952) May 16.

Equipment and techniques used in England for handling radioactive isotopes are briefly reviewed. Nine photographs are also included showing the containers and how they are used.

RADIOTHERAPY

3742

RADIOACTIVE IODINE; ITS APPLICATION IN MEDICINE. Enrique B. del Castillo. Semana méd. (Buenos Aires) 101, 369-80(1952) Mar. 27. (In Spanish)

A comprehensive discussion of the use of I^{131} in diagnosis and therapy is presented. The fate of I^{131} in the organism and the action of the thyroid in its metabolism are considered; a diagram shows the relation between uptake and elimination in normal subjects and in subjects having an abnormal thyroid condition. Equipment needed for monitoring the radioactivity is briefly listed; diagnostic procedures for using I^{131} are outlined; and some of the complications observed following its use are mentioned.

TRACER APPLICATIONS

3743

Atomic Energy Project, Western Reserve Univ.

I^{131}-LABELLED SERUM ALBUMIN—ITS USE IN THE STUDY OF CARDIAC OUTPUT AND PERIPHERAL VASCULAR FLOW, by William J. MacIntyre, John P. Storaasli, Harvey Krieger, Walter H. Pritchard and Hymer L. Friedell. Issued Mar. 11, 1952. 28p. (NYO-1642)

The use of I^{131} labeled serum albumin is described in its application to the determination of cardiac output and observation of peripheral vascular flow. A description of the equipment required for these problems and for vascular-flow measurements in general with this technique is included. A general outline is given of the cardiac outputs obtained by the rotameter and Fick procedures. The general character of the curves obtained on peripheral vascular flow measurements is discussed and experiments, designed to alter the flow by utilization of heat, cold, and arterial and venous obstruction, are described. The curves obtained from these experiments are shown along with similar curves taken on an arteriosclerotic patient. Possible interpretation and evaluation of these curves are outlined. (auth)

CHEMISTRY

3744

Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech.

THE KINETICS OF THE OXIDATION OF IRON (II) BY BROMINE, by Paul R. Carter and Norman Davidson. [nd] 22p. (AECU-2026; Contribution No. 1662)

The kinetics of the oxidation of Fe(II) by aqueous Br has been investigated spectrophotometrically at an ionic strength of 1.00 maintained with Na ions and perchlorate ions. The rate law is given. The probable mechanism is (1) $Fe^{++} + Br_3^- \rightleftharpoons Fe^{+3} + Br_2^- + Br^-$ and (2) $Fe^{++} + Br_2^- \rightarrow Fe^{+3} + 2Br^-$. The inhibition by ferric ion is strong evidence for this reaction path and eliminates an alternate path involving Fe(IV) as the unstable intermediate. The available thermodynamic estimates give for reaction (1), $\Delta F^\circ_{298} = 8.8$ kcal, $\Delta H^\circ_{298} = 1.0$. Additional terms in the rate law which apply in the presence of hypobromous and phosphoric acids are given.

3745

Oak Ridge National Lab.

THE PRODUCTS OF RIBONUCLEIC ACID HYDROLYSIS AND ENZYMOLYSIS (abstract), by Waldo E. Cohn and Elliot Volkin. [nd] 1p. (AECU-2033)

It has been shown previously that the hydrolysis of ribonucleic acid (RNA) by alkali yields each of the four expected mononucleotides in two isomeric and interconvertible forms (designated a and b), neither of these forms being phosphorylated in the 5′ position; whereas the enzymolysis by diesterases of snake venom and of intestine yield primarily the latter and little of the former. The picture of RNA structure which arises from these and related observations is that of a chain of 3′, 5′ and/or 2′, 5′ phosphoester linkages. This is now further strengthened by the isolation by Markham and Smith and by us, from ribonuclease digests, of di- and trinucleotides which can more clearly be shown, by subsequent hydrolysis and enzymolysis, to be a chain of nucleosides linked by b (3′), 5′ phosphodiester bonds. The bulk, if not all, the ribonuclease-produced substances (excepting the pyrimidine mononucleotides) are di- and trinucleotides containing one pyrimidine nucleotide in each, this being located at one

end of the molecule and being of the b type with respect to the end (secondary) phosphate group. The absence of the a form (2′ ester?) from these digests in contrast to its presence in the venom diesterase digests seems to indicate a special function, perhaps that of branch points, for the a, 5′ diphosphonucleoside, which probably arises from triphosphorylated ribose in the intact RNA as postulated by Brown and Todd. (Entire report. Abst. of paper for 2nd Internatl. Congress of Biochemistry, Paris, July 21-28, 1952)

3746

Los Alamos Scientific Lab.

THE VAPOR PRESSURE OF THALLOUS OXIDE, by R. N. Mulford. Jan. 18, 1952. 11p. (LA-1373)

Purified thallous oxide was prepared from impure commercial hydroxide and its vapor pressure determined by the Knudsen effusion method. The vapor pressure is reported as 0.001 atm. at 840°K and the heat of sublimation as 29 ± 6 kcal per mole. (auth)

3747

Sterling Chemistry Lab., Yale Univ.

HIGH FIELD CONDUCTANCE RESEARCH, by Andrew Patterson, Jr. Apr. 15, 1952. 31p. (NP-3782; Technical Report No. 1; U21702)

Experimental data are being obtained in order to test the theories of Onsager and Wien concerning the behavior of electrolytic solutions under high field excitation. A differential pulse transformer bridge was used in place of a barretter bridge, with a conventional multivibrator-power amplifier device for providing the low-field pulses and an MIT model-9 megawatt pulse modulator for the high-field pulses. Conductance cells were devised from 1-liter conical flasks, with Pt-electrode compartments of U glass construction on the sides. The electrolyte solutions were stirred magnetically, and the conductance cells were kept at constant temperature in an oil bath. Pulse amplitudes were determined by direct measurement with a calibrated capacitative voltage divider and an oscilloscope. Conductance data are given for poly-4-vinyl-N-butylpyridinium bromide (I), $MgSO_4$, $ZnSO_4$, and HAcO. The high-field conductance of a 0.00105M I solution in H_2O increased by 13% at 10 kv/cm, whereas that for AcOH increased about 0.2%. The dependence of the conductance of I with pulse width indicated a time-of-relaxation effect in which relaxation time was about 4 to 5 μsec. Measurements of high-field conductance quotient for $MgSO_4$ and $ZnSO_4$ exhibited theoretical values about 1.5 and 1.7 units lower than experimental values, respectively. (NRS abst.)

3748

Towne Scientific School, Univ. of Penna.

THERMODYNAMIC STUDY OF IRON-OXYGEN-SULFUR SYSTEM; SEVENTH QUARTERLY REPORT, by F. J. Dunkerley, J. L. Nichols, E. J. Delgrosso, and V. V. Damiano. Apr. 15, 1952. 7p. (NYO-731)

Runs to determine SO_2 equilibrium with liquid Fe were made at 1600°C using partial pressures of SO_2 ranging from 8.9×10^{-6} to 3.76×10^{-5} atm. At this temperature K = 0.308×10^3 was determined for the reactions $SO_2 = \underline{S}$ (% in liq. Fe) + 2O (% in liq. Fe).

3749

CONTRIBUTION TO THE CHEMISTRY OF BERYLLIUM. REDUCTION OF THE SULFATE; SULFURIZATION OF THE OXIDE; NEW REACTIONS OF THE CHLORIDE. Pierre Silber. Ann. chim. (12) 7, 182-233(1952) Mar.-Apr. (In French)

$BeSO_4$ can be reduced to BeS, but hydrogenous reducing agents must be avoided. Mo, W, and WC have no action on the sulfate. Mg reacts too violently to permit detailed study. Reduction by S vapor, CO, CaC_2, Zn, and Al has been studied systematically; Al gives the best results. $BeSO_4$ is formed in good yield with respect to the metal by the action of CS_2 on BeO at 1200°C, but the yield is poor with respect to the sulfide. The action of H_2S and phenol on $BeCl_2$ in anhydrous benzene, CCl_4, CS_2, bromoform, and iodoform is highly conditioned by the solubility of the reactants and products in the organic media. Be phenoxide, $Be(C_6H_5O)_2$, can be prepared readily by boiling a solution of phenol in benzene containing a suspension of $BeCl_2$. At 20°C, $BeCl_2$ reacts slowly with chloroform to give $Cl_3C-Be-Cl$, which on boiling reacts incompletely to give $Cl_3C-Be-CCl_3$. $Br_3C-Be-Cl$ is formed on contact of bromoform and $BeCl_2$.

3750

INTERACTION OF CONFIGURATIONS IN ATOMS OF THE BERYLLIUM TYPE. A. P. Yutsis and V. I. Kavetskis. Zhur. Eksptl'. i Teoret. Fiz. 21, 1139-45(1951) Oct. (In Russian)

The effect of electron-configuration interaction on the energy of the fundamental configurations of the isoelectronic atoms Li^-, Be, B^+, C^{++}, N^{+3}, and O^{+4} is calculated and compared with experimental data. The stability of negative ions of the alkali metals is discussed.

ANALYTICAL PROCEDURES

3751

Vitro Corp. of America

DETERMINATION OF RADIUM IN RESIDUES; DISSOLUTION OF THE SAMPLE IN CONDENSED PHOSPHORIC ACIDS, by C. A. Wamser, E. Bernsohn, R. A. Keeler and J. Onacki. [nd] Decl. May 19, 1952. 8p. (AECD-3381; KLX-23-75-N)

The method described was developed for the determination of Ra in residues containing silica, Ba and Pb sulfates, and other oxides and sulfates. The sample is heated in a Pt vessel with H_3PO_4 and HF. On continued heating, silica, excess HF, and sulfate are evolved, and the resultant clear, viscous melt is completely soluble in water. Ra may be determined in an appropriate aliquot of this solution by the standard $BaCl_2$ carrier precipitation procedure. (auth)

3752

Michigan State Coll.

A FLAME PHOTOMETRIC DETERMINATION OF CALCIUM, STRONTIUM, AND BARIUM IN A MIXTURE, by Orville N. Hinsvark, Sylvan H. Wittwer, and Harold M. Sell. [nd] 9p. (AECU-2025)

A flame photometry method for determination of small quantities of Ca, Sr, and Ba found in a mixture in plant tissues is described. Analysis of solutions of known quantities of these elements when added to perchloric acid as the carbonates is possible after a graphical correction for the interference to Ca from Sr, and Ba from Ca. Regulation of the acetylene pressure to provide the proper emission intensity of a standard is necessary to give accurate and reproducible results. (auth)

3753

Ames Lab.

TITRATION OF PHENOLS IN NONAQUEOUS SOLVENTS, by James S. Fritz and Robert T. Keen. Ames Lab. and Keystone Oil Refining Co. [nd] 14p. (AECU-2029)

Most analytical methods for macro amounts of phenols involve either bromination or acetylation. However, aromatic amines interfere with bromination and both alcohols and amines interfere with acetylation methods. This paper describes the titration of phenols as acids with sodium or potassium methoxide using a visual indicator. Most negatively substituted phenols give sharp end points using dimethylformanide as the solvent and azo violet indicator. Phenols lacking negative substituents give fairly good end points in anhydrous ethylenediamine using o-nitroaniline indicator. Aminophenols, hydroxybenzoic acids, resorcinol, and a few other phenols cannot be titrated by this method. Carboxylic acids interfere but can be accounted for by a differential titration. Advantages of this method are speed, convenience and noninterferences of amines, aromatic hydrocarbons, and small amounts of alcohols. (auth)

3754
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF SUB-MICROGRAM QUANTITIES OF ARSENIC BY RADIOACTIVATION. PART I. GENERAL METHOD AND APPLICATION TO GERMANIUM DIOXIDE, by A. A. Smales and B. D. Pate. Feb. 7, 1952. 16p. (AERE C/R-859/1)

Application of the general principles of radioactivation analysis to determination of As is described. By irradiation in the Harwell pile followed by chemical separation on carrier, as little as 10^{-10} g of As were measured in simple solutions. Determination of As in GeO_2 involved the problem of determining As^{76} in the presence of As^{77} from neutron irradiation of Ge^{76}. Proportional β counting with an anthracene scintillation counter proved satisfactory down to 0.01 ppm of As.

3755
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF SUB-MICROGRAM QUANTITIES OF ARSENIC BY RADIOACTIVATION; PART II. THE DETERMINATION OF ARSENIC IN SEA-WATER, by A. A. Smales and B. D. Pate. Feb. 6, 1952. 13p. (AERE C/R-859/2)

The application of radioactivation to the determination of arsenic in small samples of sea water, taken from off the southwest of Cornwall, is described. An average value of 2.6 μg As/liter (min. 1.6, max 5.0) was obtained. (auth)

3756
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DETERMINATION OF SUB-MICROGRAM QUANTITIES OF ARSENIC BY RADIOACTIVATION. PART III. THE DETERMINATION OF ARSENIC IN BIOLOGICAL MATERIAL, by A. A. Smales and B. D. Pate. Feb. 6, 1952. 18p. (AERE-C/R-859/3)

Application of the radioactivation method to determination of As in biological materials such as human hair, nails, urine, and blood, and the internal organs of a mouse is described. Amounts of As as small as 10^{-10} g may be determined so that the normal level of As in human blood or urine may be determined on one drop of sample. General advantages of the activation method are summarized. (auth)

3757
Knolls Atomic Power Lab.
THE SPECTROGRAPHIC DETERMINATION OF BERYLLIUM IN AIR DUST, by F. P. Landis. May 5, 1952. 23p. (KAPL-726)

A spectrographic method is described for the estimation of Be in samples of air dust taken on large filter papers. The analysis lines Be:2348.6 and Be:2494.7 are used and compared with internal standard lines Pt:2440.1 and Pt:2498.5. The effects, in the arc, of extraneous contaminants such as Fe, H_2SO_4, etc. and of several mixed contaminants, the more common oxides to be found in air, were studied. Data are given on concentrations of Be found in several samples of coal and cement used in the area. The absolute sensitivity of the method is 0.2 μg of Be per sample without special sample treatment. The precision, in the optimum range of 1 to 50 μg per sample, is ±15% of the amount of Be present. (auth)

3758
CHEMICAL ANALYSIS BY X-RAYS. C. H. Shaw. Ohio J. Sci. 52, 134-45(1952) May.

A review of the development of chemical analysis by x rays is given. Diagrams are given of the Bragg x-ray spectrometer, Friedman's arrangement for ultimate analysis by fluorescent x-rays, and a powder diffraction camera. Spectra are given of Fe, a mixture Sm^{62} and Gd^{64} salts, and Fe and Mn in an Al-base alloy. A powder diffraction pattern of Mo taken with Fe Kα radiation is also included.

3759
RADIOACTIVE METHODS OF ANALYSIS. G. D. Calkins. Ohio J. Sci. 52, 151-60(1952) May.

A brief review of the radioactive methods of analysis is given. The methods described are: tracer techniques, dilution studies, and neutron activation.

LABORATORIES AND EQUIPMENT

3760
A SIMPLE PIPETTING DEVICE. J. A. McCarter. Science 115, 552(1952) May 16.

A device for pipetting solutions of soft-β emitters is described briefly. It consists of a three-way glass stopcock with an outlet through the bottom of the stopper. The side arms are cut off, leaving convenient lengths. To one side arm a short length of thick-walled gum-rubber tubing is fitted for attachment to the pipet. To the outlet through the stopper a rubber bulb of convenient capacity is attached.

RADIATION CHEMISTRY

3761
Argonne National Lab.
THE DISSOCIATION OF ETHYL BROMIDE AND IODIDE BY NEUTRON CAPTURE, by Sol Wexler and T. H. Davies. Argonne National Lab. and Institute for Nuclear Studies, Univ. of Chicago. Apr. 1952. 27p. (AECU-2017; UAC-557)

A study has been made of recoil halogen species ejected from gaseous ethyl bromide and iodide after neutron capture. The results demonstrate that a fraction of the radiohalide fragments carry a positive charge. The fraction charged is 12% for the 4.4-hr Br^{80m}, 25% for the 34-hr Br^{82}, and 50% for the 25-min I^{128}. The corresponding estimate for the 18 min Br^{80} is very approximately 18%. The positive charges are attributed to internal conversion processes in the stabilization of the compound nucleus formed by neutron capture. The fraction of positive recoil ions is interpreted as the minimum fraction of neutron capture processes which are followed by an internal conversion process. A comment is made upon the possible significance of the ions in the study of chemical reactions induced by radiative neutron capture. A study of the 18-min Rb^{88} from β decay of the 2.8-hr Kr^{88} was made using the procedures and equipment employed in the halogen experiments. The results show that all Rb^{88} atoms are positively charged as expected. (auth)

RADIATION EFFECTS

3762
Yale Univ.
EFFECT OF GAMMA RADIATION ON CHEMICAL REACTIONS. II. PRELIMINARY INVESTIGATION OF VAPOR-PHASE POLYMERIZATION OF ACETYLENE AND ETHYLENE; PROGRESS REPORT NO. 2 (First Quarter, 1952). Apr. 25, 1952. 12p. (NYO-3309; Progress Report No. 2)

The irradiation of samples of acetylene at room temperature and atmospheric pressure has been found to result in the formation of a solid polymer, and the apparent formation of benzene or of an aromatic compound of molecular weight greater than benzene in the vapor phase. A sample of ethylene is being irradiated under similar conditions and appears to be polymerizing at the rate of about 1% per day. This rate corresponds to an ion-pari yield of the order of magnitude of 30. A chain-type mechanism is therefore indicated. Equipment described includes a radiation warning system, glass reaction vessels, and a hollow-bore access plug which permits a reaction vessel to be connected to a pressure measuring device when the former is in position in the Co^{60} vault.

RARE EARTHS AND RARE-EARTH COMPOUNDS

3763

Ames Lab.

THE PREPARATION OF YTTRIUM AND SOME HEAVY RARE EARTH METALS, by A. H. Daane and F. H. Spedding. May 14, 1952. 10p. (ISC-226)

A method was devised for preparing massive metallic Y, Dy, Ho, and Er in high purity and high yields by reducing the rare earth chloride or fluoride with Ca metal in Ta containers in an inert atmosphere. Tb and Tm salts were reduced to give high yields of sintered metal which were arc melted to give massive specimens. Ytterbium fluoride could be reduced only to the divalent state by the technique employed in this work. Estimated maximum melting points of some of these metals are given. (auth)

3764

Los Alamos Scientific Lab.

PRELIMINARY INVESTIGATION OF THE LANTHANUM-HYDROGEN AND LANTHANUM-NITROGEN SYSTEMS, by R. N. Mulford. Jan. 15, 1952. 22p. (LAMS-1374)

The existence of a compound, LaH_2, has been deduced from experimental results based on pressure-temperature-composition data. These results have been substantiated by means of x-ray and metallographic investigations. Similar evidence is offered for the existence of a compound at or near LaN. The heats of formation for the reactions $La(s) + H_2(g) \rightarrow LaH_2(s)$ and $LaH_2(s) + H_2(g) \rightarrow LaH_2(s) + H_2(dissolved)$ have been calculated from pressure-temperature-composition data, and are given as $\Delta H = -43$ kcal/mole and $\Delta H = -6$ kcal/mole, respectively. (auth)

SEPARATION PROCEDURES

3765

Los Alamos Scientific Lab.

RaD PURIFICATION, Po PREPARATION, AND CALIBRATION OF MEASURING APPARATUS, by R. J. Prestwood. Jan. 21, 1944. Decl. May 19, 1952. 13p. (AECD-3380; LADC-293)

RaD (Pb^{210}) is purified from solution by electrolysis at various current densities, and a procedure is described for extracting Po sources on Pt electrodes. In measuring the strength of the sources, difficulty was encountered with nonlinearity of the microammeter of an integrating ionization chamber, and the method of calibrating this in several degrees of sensitivity is described in detail. (auth)

3766

Rensselaer Polytechnic Inst.

SOLVENT EXTRACTION OF INORGANIC IONS; THE TERNARY SYSTEM: ISOPROPYL ETHER–HCl–H_2O, by D. E. Campbell and A. H. Laurene. Mar. 20, 1952. 21p. (NYO-614)

The ternary system isopropyl ether–HCl–H_2O has been studied at 20°C. A complete ternary diagram is presented along with plots of (1) the distribution coefficient of HCl as a function of the equilibrium concentration in the aqueous phase, (2) the variation in the equilibrium concentration of HCl in the aqueous phase as a function of the initial hydrochloric acid concentration for equal volume extraction and (3) density data used for analysis of the aqueous phase in the equilibrium study. The system is of interest in connection with the extraction from hydrochloric acid solution by isopropyl ether of inorganic substances such as ferric chloride. In the light of the results obtained, it is possible to interpret the known fact that optimum conditions for extraction of inorganic chlorides exist over a narrow range of hydrochloric acid concentration. (auth)

3767

THE SEPARATION OF SUGARS BY ION EXCHANGE. Joseph X. Khym and Leonard P. Zill. J. Am. Chem. Soc. 74, 2090-2(1952) Apr. 20.

An abstract of this material was indexed as report AECU-1688 and appears in Nuclear Science Abstracts as NSA 6-148.

SPECTROSCOPY

3768

Stamford Research Labs., American Cyanamid Co.

INFRARED ANALYSIS OF n-HEXADECAFLUOROHEPTANE AND HEXADECAFLUORODIMETHYLCYCLOHEXANE, by Van Zandt Williams and James L. Johnson. [nd] Decl. May 5, 1952. 14p. (AECD-3370; A-3959)

By the use of infrared spectroscopy some of the impurities in n-hexadecafluoroheptane and hexadecafluorodimethylcyclohexane have been identified and accurate specification analyses have been devised for measuring these impurities. These infrared analytical methods were used as an aid in setting acceptance specifications on the materials and for determining whether production materials met specifications.

TRACER APPLICATIONS

3769

Wisconsin Univ.

APPLICATIONS OF RADIOTRACERS TO THE STUDY OF SURFACES, by John E. Willard. [nd] 14p. (AECU-2021)

This paper discusses ways in which radiotracers can be useful as tools in the study of reactions of surfaces. Illustrations are taken from several types of investigations. New information is presented on the reaction of bromine vapor with glass, on a method for the determination of sticking coefficients of gaseous particles striking surfaces, and on the reaction of unsaturated vapors of organic compounds with surfaces in evacuated systems. (auth)

3770

APPLICATION OF RADIOACTIVE ISOTOPES TO THE STUDY OF CHEMICAL REACTION MECHANISMS. Pascaline Daudel. Bull. soc. chim. France, 23D-27D(1952) Mar.-Apr. (In French)

Various published studies on reaction-mechanism problems elucidated with radioisotope tracers are reviewed briefly. 68 references.

URANIUM AND URANIUM COMPOUNDS

3771

Atomic Energy Research Establishment, Harwell, Berks (England)

THE COMPLEX IONS FORMED BY THORIUM AND URANIUM WITH COMPLEXONES, by M. J. Cabell. July 27, 1951. 31p. (AERE-C/R-813)

Potentiometric titrations have been used to show that thorium and uranyl ions from complexes with nitrilotriacetic acid (NTA) and ethylenediamine tetraacetic acid (EDTA). In the case of thorium the shapes of the titration curves indicate definite stable ionic species. The uranyl complexes are much less stable, hydrolyze much more readily and the uranium is precipitated as the pH is increased. The acid dissociation constants of NTA and EDTA have been measured at room temperature in 0.1M KCl solution. (auth)

3772

Argonne National Lab.

PRELIMINARY DATA ON THE PHASE EQUILIBRIUM SYSTEMS UO_2–MgO; U_3O_8–MgO; UO_2–Nd_2O_3; U_3O_8–Nd_2O_3; AND UO_2–Al_2O_3, by Wingate A. Lambertson and Melvin H. Mueller. Apr. 8, 1952. Decl. Apr. 22, 1952. 43p. (AECD-3376; ANL-HDY-704)

Preliminary work on the above phase equilibrium systems shows the general nature of the diagrams and the compounds and solid solutions which occur. The UO_2–MgO system is that of a simple eutectic with no compounds or solid solutions. U_3O_8–MgO mixtures form MgU_3O_{10}, $MgUO_4$, and cubic solid solution. The UO_2–Nd_2O_3 system contains considerable

solid solution on the UO_2 side and a small amount of an unidentified phase. U_3O_8–Nd_2O_3 gives one new phase with a wide solid solution range. UO_2–Al_2O_3 forms a simple eutectic with no compounds or solid solution. (auth)

3773

EQUILIBRIA OF URANIUM OXIDES BETWEEN UO_2 AND U_3O_8. H. Hering and P. Perio. Bull. soc. chim. France, 351-7(1952) Mar.-Apr. (In French)

On the basis of x-ray-crystallographic studies of the four crystalline species appearing in the UO_2-U_3O_8 system between 120 and 900°C, the authors propose an equilibrium diagram. A cubic domain exists on both sides of UO_2. Above ~260°C, the mixtures rich in O decompose with formation of $UO_{2.25}$, also cubic. The authors consider this identical with β-$UO_{2.19}$ described by Alberman and Anderson (J. Chem. Soc., 303(1949)). The tetragonal oxide changing in composition from $UO_{2.40}$ to $UO_{2.30}$ with increasing temperature decomposes above 480 to 500°C, giving $UO_{2.25}$ and the orthorhombic phase. This has U_3O_8 as its upper limit; its lower limit is displaced by temperature elevation to compositions low in O.

ENGINEERING

AEROSOLS

3774

Atomic Energy Project, Univ. of Rochester

DESIGN OF AN OSCILLATING THERMAL PRECIPITATOR, by K. E. Lauterbach, R. H. Wilson, S. Laskin and D. W. Meier. Apr. 25, 1952. 24p. (UR-199)

In a thermal precipitator the deposit is uniform lengthwise, but variable with respect to average particle size and particle number in traversing the width. By means of a linear-motion cam in the unit described here, the collection slide can be oscillated during sampling in a direction parallel to the air flow path, thus effectively mixing large and small particles as they are deposited. The resulting specimen is in the form of a rectangle, ⅝ in. by ½ in. In parallel determinations, the collection efficiency of the instrument has been evaluated as 99.9+%. For all particles below 1.0μ. This applies for sampling rates up to 20 cc/min.

HEAT TRANSFER AND FLUID FLOW

3775

Oak Ridge National Lab.

THEORETICAL AND EXPERIMENTAL ANALYSES OF NATURAL CONVECTION WITHIN FLUIDS IN WHICH HEAT IS BEING GENERATED. PART V. NATURAL CONVECTION VELOCITY MEASUREMENT IN A PARALLEL PLANE SYSTEM, by R. F. Redmond. Feb. 12, 1952. 10p. (CF-52-1-5)

3776

Oak Ridge National Lab.

A CRITICAL REVIEW OF THE LITERATURE ON PRESSURE DROP IN NONCIRCULAR DUCTS AND ANNULI, by H. C. Claiborne. Issued May 22, 1952. 16p. (ORNL-1248)

The literature is critically examined for pressure drop data on isothermal fluid flow in the turbulent regime through noncircular ducts, annuli and parallel flow systems, i.e., fluid flow parallel to the exterior surfaces of tube banks. The results were correlated on the basis of the conventional equivalent diameter and compared to the classic round-pipe data. The results of 12 authors for 30 widely different geometries agreed with the round-pipe data to within ±15 per cent for Reynolds moduli greater than 5000 and ±35 per cent for Reynolds moduli between 2100 and 5000. (auth)

3777

OPERATOR METHODS IN GAS DYNAMICS. Stefan Bergman. Z. angew. Math. u. Mech. 32, 33-45(1952) Feb.-Mar. (In German)

When using the hodograph method for irrotational compressible subsonic flow problems, the theory of analytic functions of a complex variable has to be generalized to the case of more general linear partial differential equations of elliptic type. For this purpose integral operators transform the class of the analytic functions of a complex variable into the class of the stream functions representing subsonic flows of ideal gases around profiles of arbitrary shape. The operator method is extended to the mixed case. (auth)

PUMPS

3778

General Engineering Lab., General Electric Co.

ELECTRO-MAGNETIC PUMP VIBRATION ANALYSIS, by R. J. Wells and R. W. Griessel. Jan. 29, 1952. 39p. (KAPL-721)

The vibrations which occur during the operation of a polyphase a-c electromagnetic induction pump were investigated. The pumping force sets up waves in the liquid sodium being pumped, which, at certain frequencies, resonate in the connected piping and cause both unwanted audible noise and harmful mechanical vibrations. The noise is objectionable in a submarine where such a pump may be used, and also the vibrations are a potential source of structural fatigue. The pump and its various members comprise a vibrating system. By means of acoustic circuits (analogous to electric circuits), the individual parts of the system were analyzed. A vibration frequency range 5 to 120 cps was considered. It was found that the main resonances in the unmodified pump loop occurred between 40 and 50 cps. The pumping system was modified by different size helium "gas bubbles" at each end of the pump and the same information computed and graphed. The modifications reduced the value of the resulting force at all positions and at all frequencies except those at 5 cps. Since in service such a pump will normally operate at a constant frequency, it should always be possible to "tune" the gas bubble for best results at the operating frequency.

VACUUM SYSTEMS

3779

Carbide and Carbon Chemicals Co. (K-25)

SOME MISCELLANEOUS VACUUM COATER TECHNIQUES, by A. E. Cameron. Issued May 12, 1952. 7p. (K-909)

Removal of evaporated films from a bell jar is facilitated if a thin layer of potassium chloride has been applied to the glass. A design of boat is described which enables the evaporation of gram quantities of some fluorides and of many metals. A means of producing a strong mechanical and electrical bond from tungsten to carbon is suggested. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

3780

Battelle Memorial Inst.

THE CORROSION OF NITRIDED STAINLESS STEELS IN DEGASSED AND OXYGENATED WATER, by H. A. Pray and R. S. Peoples. May 1, 1952. 37p. (BMI-742)

Corrosion studies were designed to determine the behavior of nitrided 17-4PH and nitrided 322 W stainless steels coupled with various materials in degassed and oxygenated water at room temperature, 200°F, and 500°F. Uncoupled specimens of all materials, tested for comparison, exhibited satisfactory corrosion resistance with the exception of nitrided 17-4PH and 322 W alloys at room temperature or 200°F. In the couple tests, at room temperature and 200°F, the majority of the couples showed a buildup of corrosion product along the periphery of the contact area. At 500°F little or no buildup was observed, but pitting was detected in the contact area on samples of Stellites coupled with the nitrided alloys. Of the couples tested, only the Haynes 25 versus Cr-plated 17-4PH exhibited satisfactory corrosion properties under all test conditions. Significant differences in the pH and specific resistance between the oxygenated and degassed water were observed only for the 200°F tests.

GEOLOGY AND MINERALOGY

3781

[Pennsylvania State Coll.]

AN INVESTIGATION OF THE MINERALOGY AND PETROGRAPHY OF URANIUM-BEARING SHALES; SECOND PROGRESS REPORT PERIOD OCTOBER 1–JANUARY 1, 1952. [nd] 10p. (AECU-1942)

X-ray and microscopic examinations were made of samples of the Chattanooga shale, Maury shale, and Brassfield shale collected in Tenn. A fresh sample obtained from the Oak Ridge National Lab. (Caney Fork 9-1) and a series of six samples, collected in southeast Tenn., ranging from the Maury shale to the Brassfield shale were selected for a detailed study. X-ray patterns, differential thermal curves and electron micrographs indicate that the predominant clay in all three shales is the non-expanded dioctahedral 2:1 variety. In addition the Chattanooga contains some chlorite and the Brassfield considerable halloysite. β-γ counts indicate that about 20% (0.002) of the radioactivity in the Chattanooga shale and probably all the activity in the Maury and Brassfields shales is due to the potassium which occurs in the non-expanded dioctahedral 2:1 clay mineral. The less-than-one-micron fraction of each of the seven samples was obtained in order to make a chemical analysis of the clay minerals in the shales. The heavy minerals were separated from the samples and further subdivided with a Frantz Isodynamic magnetic separator. (auth)

3782

Bureau of Mines

METHOD OF CONCENTRATING KEROGEN IN COLORADO OIL SHALE BY TREATMENT WITH ACETIC ACID AND GRAVITY SEPARATION, by Arnold B. Hubbard, H. N. Smith, H. H. Heady, and W. E. Robinson. Apr. 1952. 17p. (BM-RI-4872)

A method of concentrating the insoluble organic material (kerogen) in a rich Colorado oil shale without any apparent alteration of its original chemical form is described. The method involved treating finely pulverized shale with dilute acetic acid at room temperature to remove the carbonates, which act as a cementing agent for the shale, and cause the shale particles to partly disintegrate into the organic and inorganic components. The acid-treated shale then was centrifuged in different liquid mediums ranging from 1.4 to 1.15 gravity to effect a mechanical separation. From a Colorado oil shale containing 48.0% ash, kerogen concentrates containing 43.3 to 8.7% ash were obtained.

METALS AND METALLURGY

3783

North American Aviation, Inc.

SOME EFFECTS OF IRRADIATION ON METALS, by W. E. Parkins. Issued Jan. 28, 1952. Decl. with deletions May 15, 1952. 27p. (AECD-3372; NAA-SR-MEMO-205)

An investigation of the effects of radiation on intermetallic diffusion is reviewed. From studies of Au-Cu and Cu-Ni powder compacts exposed to the Berkeley 60-in. cyclotron or in a Hanford reactor, it was concluded there is very little or no effect of radiation on the diffusion rate. Au-Cu couples exposed in a Hanford reactor showed no large effect of the irradiation on the measured intermetallic diffusion rate. Comparison is made of measurements of hardness and metallographic examinations of samples of stainless steel before and after irradiation. Changes observed in mechanical properties of the irradiated steel samples were reversed by annealing to temperatures of a few hundred degrees C. Data from in-place measurements of electric resistivity of stainless steel made to explore the rate at which changes are produced during cyclotron bombardment indicate a trend toward some saturation value. Data are presented graphically and a schematic drawing of a heater assembly for cyclotron irradiation-diffusion experiments is included.

3784

Battelle Memorial Inst.

THE PROPERTIES OF BERYLLIUM, by Murray C. Udy, Homer L. Shaw and Francis W. Boulger. July 15, 1949. Decl. with deletions May 20, 1952. 154p. (AECD-3382; BMI-T-14)

A bibliography on the properties of Be is given. The physical, electrical, optical, magnetic, chemical, mechanical, and nuclear properties are briefly reviewed. The methods of purification and fabrication are also given.

3785

Notre Dame Univ.

SURVEY OF PORTIONS OF THE CHROMIUM-COBALT-NICKEL-MOLYBDENUM QUATERNARY SYSTEM AT 1200°C, by Sheldon Paul Rideout and Paul A. Beck. Apr. 1952. 81p. (NACA-TN-2683)

A survey was made of portions of the chromium-cobalt-nickel-molybdenum quaternary system at 1200°C by means of microscopic and x-ray diffraction studies. Since the face-centered cubic (alpha) solid solutions form the matrix of almost all practically useful high-temperature alloys, the solid solubility limits of the quaternary alpha phase were determined up to 20 percent molybdenum. The component cobalt-nickel-molybdenum, chromium-cobalt-molybdenum, and chromium-nickel-molybdenum ternary systems were also studied. The survey of these systems was confined to the determination of the boundaries of the face-centered cubic (alpha) solid solutions and of the phases coexisting with alpha at 1200°C. (auth)

3786

Battelle Memorial Inst.

A FUNDAMENTAL STUDY OF THE MECHANISM BY WHICH HYDROGEN ENTERS METALS DURING CHEMICAL AND ELECTROCHEMICAL PROCESSING, by L. D. McGraw, C. A. Snavely, H. L. Moore, P. T. Woodberry and C. L. Faust. Apr. 1952. 43p. (NACA-TN-2696)

Through the correlation of several known methods of controlling entry and exit of hydrogen in steel with the known chemical behavior of atomic and molecular hydrogen suitable reagents were found which increase or, for the first time, significantly decrease hydrogen permeability and embrittlement of steels during cathodic pickling and plating operations. This successful correlation was an important step toward arriving at the mechanism of hydrogen entry into steel. It is proposed that entry is through the direct formation of metal hydrides (intermetallic compounds) or solid solutions of hydrogen in metal at the instant of hydrogen discharge and that exit is the decomposition of metal hydrides or of solid solutions of hydrogen in metal. (NACA abst.)

3787
Columbia Univ., School of Mines
THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS; PROGRESS REPORT FOR DECEMBER 1 TO FEBRUARY 29, 1952, by T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, R. Bakish, J. Intrater and M. Wechsler. [nd] 6p. (NYO-935)

The cubic-orthorhombic transformation in Au-47.5% Cd was found to take place on application of a tensile load during thermal cycling by the movement of a single interface to give a single crystal of the orthorhombic phase. An electrolytic etching technique was developed which permitted traces of markings present in the low-temperature phase for only 10 min to be obtained after retransformation to the high-temperature phase. A single crystal of 50 at. % Au-Cd was annealed at 450°C and quenched to room temperature. The variation with time of the peak and integrated intensities of the 200 and 100 (superstructure) reflections was observed at various temperatures. It was found that the peak intensity of the 100 reflection decreased relative to the 200 reflection, whereas the integrated intensities of the 100 reflection remained essentially constant. The diffusionless phase change from the f.c.c. to the f.c.t. phases, the effect of stress on the twinned orientations, and the nature of hysteresis in the In-Tl alloys are described. The habit planes of the martensite transformation in Cu-24.4% Sn were found to be b.c.c. {133}.

3788
[Massachusetts Inst. of Tech.]
STRAIN HARDENING AND STRAIN SOFTENING OF STEELS AT ELEVATED TEMPERATURES, by D. A. J. Millar and J. Wulff. [nd] 33p. (NP-3735)

A comparison is made between the stress-strain behavior of mild steel and that of an age-hardenable steel such as Timken 16-25-6 alloy. At elevated temperatures, the former still exhibits slight strain hardening, whereas the other undergoes strain softening. In the absence of obvious cracking, it is postulated that the grain boundary precipitates in the alloy can be dissolved at temperatures as much as 350°F below the solutionizing temperatures by continuous deformation. For temperatures below the solutionizing temperatures, the cessation of straining for a period as short as 5 minutes causes precipitation hardening. These theories are borne out by metallographic examination.

3789
[Massachusetts Inst. of Tech.]
CONSTANT STRAIN RATE TESTS AT ELEVATED TEMPERATURES, by E. L. Bartholomew, D. A. J. Millar and John Wulff. [nd] 29p. (NP-3736)

The major design and operational features of a new tensile testing machine for conducting constant true-strain-rate tests at elevated temperatures are described. Data are reported on the tensile behavior of mild steel tested at strain rates between 120×10^{-5} sec^{-1} and 600×10^{-5} sec^{-1}, at temperatures between 1650°F and 2200°F. The results of these tests indicate that the relations between stress, strain rate, and temperature correspond to the general reaction-rate theory. Strain-rate history, as well as strain history, is shown to be of significance. The data conform with the velocity-modified temperature concept, indicating the possibility of prediction of high temperature behavior, within strict mechanical and metallurgical limits. An activation energy for deformation of steel is calculated and is found to compare favorably with values determined from creep data. (auth)

3790
Columbia Univ.
FIRST PROGRESS REPORT ON THE MECHANISM OF METALLOGRAPHIC ETCHING, by George L. Kehl and Max Metlay. June 15, 1951. 14p. (NYO-3011)

Progress is reported in an investigation of the etching mechanism in single and multiple phase alloys and in pure metals. Data are included on the measurement of open-circuit potentials made to determine the variation of free energy of reaction over the surface, the measurement of closed-circuit potentials and attendant currents between different grains which are electrically connected through a small resistor, x-ray and electron-diffraction examinations of structural changes occurring on the specimen surface and polarographic investigations into the rates of metal ion solution as etching progresses.

3791
General Electric Research Lab.
DEVELOPMENT OF ZIRCONIUM BASE ALLOYS; TENTH QUARTERLY REPORT (PROGRESS REPORT NUMBER 11), by J. H. Keeler. Apr. 5, 1952. 38p. (SO-2505; RL-680; Progress Report Number 11)

A multiple-hearth arc furnace containing nine replaceable crucibles has been constructed and placed in operation. Preliminary results indicate a marked decrease in button hardness with successive melts. A schematic section of the furnace and photographs of parts of it are shown. The recrystallization and transformation textures of Zr were determined. The grade of Zr and small variations in grain size did not appreciably influence the tensile properties of crystal-bar Zr. Considerable differences were found between transverse and longitudinal specimens of both cold-reduced and recrystallized crystal bar. These differences were found to be related to the texture of the material. The influence of strain rate was shown by experiments wherein the rate of strain was varied within a single test. The amount of strain was not found to significantly influence the rate sensitivity. Zr-Nb alloys containing 18% Nb displayed unusual stress-strain curves and some evidence of strain aging. These alloys and the 10% Nb alloys appear to have a sluggish β-to-α transformation. Room-temperature tensile tests disclosed Zr-Cr and Zr-Al alloys to be somewhat similar in properties to previously tested binary alloys of Zr-Nb and Zr-Ta. Cr additions apparently contribute more greatly to strengthening than do Al additions.

3792
THE FLOW OF METALS. E. N. da C. Andrade. Engineer 193, 658-9(1952) May 16.

A review of the knowledge about the creep of metals under stress is given. The metals concerned are Pb, Cu, Fe, Cd, and solid Hg. It is shown that the creep behavior of all these and many other materials is very similar if allowance is made for temperature and can be expressed (if measured as the extension of a normal polycrystalline wire under constant stress) by the simple equation $l = l_0(1 + \beta t^{1/3})e^{\kappa t}$, where t is the temperature. The relative importance of l_0, β, and κ varies markedly with temperature. This experimentally derived relation is discussed in an endeavor to express what may be the underlying physical mechanism of creep.

3793
CRYSTAL STRUCTURE OF ZrB_{12}. Benjamin Post and Frank W. Glaser. J. Metals (N. Y.) 4, 631-2(1952) June.

The crystal structure and some properties of a hitherto unreported zirconium boride ZrB_{12} are described. Chemical analysis of the new compound showed 44% Zr and 56% B, compared with 41% Zr and 59% B computed for ZrB_{12}. The difference is within the range of error of the analytical method employed. ZrB_{12} shows marked metallic properties. It is obtained as a fine black powder. Measurements of electrical resistivity were made at –79°C, +22°C, and +64°C. At 22°C the electrical resistivity is approximately 60 μohm-cm. Over this range the temperature coefficient of resistivity is +0.00162. The thermal conductivity at room temperature is 0.122 watts/cm/°C. The product of the electrical resistivity and thermal conductivity is there-

fore 8.05, which is not far from the normal Wiedemann-Franz ratio (approximately 7.5 at room temperature). These measurements were made on hot-pressed samples which were not always high-density specimens. The hardness of ZrB_{12} on the Rockwell A scale varies between 92 and 92.5.

3794
PARTIAL TITANIUM-VANADIUM PHASE DIAGRAM. Paul Pietrokowsky and Pol Duwez. J. Metals (N. Y.) 4, 627-30 (1952) June.

Titanium and vanadium form a complete series of solid solutions at temperatures above 885°C. Below 885°C, vanadium is slightly soluble in α titanium (about 1.5% V at 650°C) and a two-phase α plus β region extends to 18.5% V at 650°C. The alloys up to 15.0% V transform into a supersaturated α solid solution upon rapid cooling from the β phase. Above 15% V the β phase may be retained. The temperature at which the β to α' martensite-type transformation takes place decreases steadily from 850°C for 0.5% V to 325°C for 12.7% V. (auth)

3795
COMPRESSION TEXTURE OF IODIDE TITANIUM. D. N. Williams and D. S. Eppelsheimer. J. Metals (N. Y.) 4, 615-8(1952) June.

The compression texture of iodide titanium is determined and found to consist of a [0001] texture rotated 15° to 30° from the axis of compression. As the amount of reduction increases, the angle of rotation decreases. The 0001 rotation showed a slight preference for a <10$\bar{1}$0> rotation axis. (auth)

3796
TITANIUM-ALUMINUM SYSTEM. E. S. Bumps, H. D. Kessler, and M. Hansen. J. Metals (N. Y.) 4, 609-14(1952) June.

The Ti-Al phase diagram was determined with iodide titanium-high purity aluminum arc-melted alloys from 0 to 64 wt.% Al. The principal features of the diagrams are as follows: (1) A peritectic reaction, β + melt $\rightleftharpoons \gamma$, between 34.5 and 38.5% Al at approximately 1460°C. (2) A second peritectic reaction, γ + melt $\rightleftharpoons TiAl_3$, between 60 and 64% Al at 1340°C. (3) A peritectoid reaction, $\beta + \gamma \rightleftharpoons \alpha$, between 29 and 34.5% Al at approximately 1240°C. (4) The $\alpha \rightleftharpoons \beta$ transformation temperature is raised from 885°C at 0% Al to 1240°C at 29% Al. A narrow $\alpha + \beta$ field is indicated. The β phase transforms to serrated α on quenching. (5) The solubility limit of aluminum in α titanium is 24.5% at 900°C. The maximum solubility of aluminum in β titanium is 34.5% at 1460°C. (6) The lattice parameters of the solid solution change considerably with initial additions of aluminum and level off near the solubility limit. X-ray diffraction patterns confirmed the metallographic observation that β is not retained by rapid quenching. (7) The γ phase is of variable composition, from 37 to 60% Al in the solidus and from 35.5 to about 44.5% Al at 800°C. (8) The γ phase has an ordered f.c.t. lattice, with an axial ratio close to unity, and is based on the composition TiAl. Increasing aluminum content increases the axial ratio slightly. (9) The hardness of α solid solution alloys increases with the addition of aluminum to titanium. The γ phase has a minimum hardness at 36% Al, which increases with further additions of aluminum, reaching a maximum at the composition $TiAl_3$. (auth)

TRACER APPLICATIONS

3797
ISOTOPIC EXCHANGE BETWEEN METALLIC SILVER AND ITS IONS IN SOLUTION. Maria do Carmo Anta and Maurice Cottin. Compt. rend. 234, 1686-8(1952) Apr. 21. (In French)

Ag powder was prepared by chemical reduction of $AgNO_3$ by NaH_2PO_2 and by electrolytic deposition from $AgNO_3$ solution. Exchange between powder screened to 0.005 cm mean diameter and $AgNO_3$ solution in N_2 atmosphere was studied with Ag^{110} tracer. Variations with temperature, method of preparation, and time in the quantity and rate of Ag exchange are described.

PHYSICS

3798
Ultrasonic and Electrochemistry Research Labs., Western Reserve Univ.
COLLOIDAL VIBRATION POTENTIALS, by Ernest Yeager, Harry Dietrick, and Frank Hovorka. Apr. 1, 1952. 42p. (NP-3776; Technical Report No. 7)

When ultrasonic waves are introduced into a colloidal suspension, alternating potentials are generated in the direction of propagation of the sound wave between points separated by a finite distance other than an integral multiple of the wave length between them. The effect is associated with periodic distortion of the diffuse ionic layer surrounding each charged colloidal particle. Mathematical analysis indicated that the amplitude of ion displacement was a function of the charge, concentration, and radius of the colloidal particles and the conductivity of the suspension. Colloidal vibration potentials were quantitatively measured with pulse-modulated ultrasonic waves at repetition frequencies of 100 to 400 sec^{-1} at pulse durations of about 500 μsec with a carrier frequency of 200 kc. Delay times (800 μsec) greater than pulse widths permitted ready differentiation of acoustically produced and electromagnetically induced effects. Open-circuit voltages calculated from observed alternating potentials for aqueous suspensions of colloidal SiO_2 at 25°C agreed with theory, particularly with respect to the magnitude and dependence of the effect on colloidal concentration and conductivity. Preliminary experiments were performed with C, S, Buna N, and Buna S. Application of the effect to the determination of the charge on large colloidal particles in systems of high ionic concentrations appeared promising. (cf. TIP U20316) (NRS abst.)

3799
THERMAL CONDUCTIVITY OF CARBONS AND GRAPHITE. S. Mrozowski. Phys. Rev. 86, 251-2(1952) Apr. 15.

The temperature dependence of the thermal conductivity of polycrystalline graphite and of a baked carbon is considered. The conductivity-vs.-temperature curves of Powell and Schofield (Proc. Phys. Soc. (London) 51, 153(1939)) are presented, and a system of predicted intermediate curves for carbons of various microcrystalline sizes is added. Comparison of the low-temperature part of the curves shows that the conductivity of baked carbons is smaller by a factor of 1000 (or more). Since crystallite sizes differ by a factor of not more than 100, and the specific heat and velocity of the waves cannot depend very strongly on crystallite size, it is clear that in addition to the pure boundary scattering there must be present some other source of resistance to the heat flow in the baked carbons. The baked-carbon conductivity curves do not join the graphitic curve at high temperatures, and no reliable estimate of the crystallite sizes can be made for baked carbons by application of the Debye formula.

AEROSOLS

3800
Columbia Univ.
FINAL REPORT ON NAVY CONTRACT; JUNE 29, 1948–JUNE 28, 1949. PART A. THE APPLICATION OF THE PERRIN THEORY TO LIGHT SCATTERING PHENOMENA

OBSERVED FROM SULFUR HYDROSOLS OF VARIOUS PARTICLE SIZES, by Victor K. La Mer and Milton Kerker. PART B. THE METHODS OF FORMING, DETECTING AND MEASURING THE SIZE AND CONCENTRATION OF LIQUID AEROSOLS IN THE SIZE RANGE OF 0.01 TO 0.25 MICRONS DIAMETER, by Victor K. La Mer, Edward C. Y. Inn and Irwin Wilson. [nd] 65p. (NP-3805)

ELECTRONS

3801

UNIFIED DESCRIPTION OF LEPTONS. V. Votruba and M. Lokajíček. Phys. Rev. 86, 260(1952) Apr. 15.

In a recent paper (Votruba, Phys. Rev. 85, 141(1952)) attention was called to the possibility that the lepton is a particle with isotopic spin 1. It is now shown that the description can be made independent of any special choice of the representation of the γ's and ξ's of that paper. The three charge-states of the lepton are to be defined as eigenstates of the operator ξ_3. The total energy of a free lepton field is then the sum of the (positive) energies of the electrons, positrons, and neutrinos, whereas the total charge is the algebraic sum of the charges of electrons and positrons. The hamiltonian of the interaction between the leptons and the nucleons is shown to vanish identically in the cases of scalar, pseudoscalar, and pseudovector coupling.

GASES

3802

Los Alamos Scientific Lab.

NOTE ON THE FREE VOLUME EQUATION OF STATE FOR HARD SPHERES, by William W. Wood. [nd] 3p. (AECU-2034; LADC-1175)

The solution of the system of equations

$$\varphi(\bar{r}) = e^{\beta(a-\psi(\bar{r}))}$$

$$\psi(\bar{r}) = \sum_1 \int_{cell} V_{11}(\bar{R}_{11} + \bar{r} - \bar{r}') e^{\beta(a-\psi(\bar{r}))}\, d\nu'$$

$$e^{-\beta a} = \int_{cell} e^{-\beta\psi(\bar{r})}\, d\nu$$

gives the equation of state for rigid spheres as

$$PV/kT = 1 + \frac{r_0}{a - r_0}.$$

3803

Thermodynamics Research Lab., Univ. of Penna.

ZERO-PRESSURE THERMODYNAMIC PROPERTIES OF SOME FIFTEEN TECHNICALLY IMPORTANT GASES, by Serge Gratch. June 1950. 84p. (NP-3791; U10571)

INSTRUMENTS

3804

Ames Lab.

A RECORDING MERCURIAL MANOMETER FOR THE PRESSURE RANGE 0-760 mm. OF MERCURY, by Harry J. Svec and Dale S. Gibbs. May 13, 1952. 13p. (ISC-225)

A recording mercurial manometer is described which covers the pressure range 0 to 760 mm Hg. In the mercury column of a large bulb manometer is concentrically positioned a Nichrome V or Chromel A resistance wire. This resistance is a part of a d-c bridge circuit with a recording potentiometer in place of the galvanometer. Circuits are presented which are designed to handle a variety of experimental conditions. (auth)

3805

Norman Bridge Lab. of Physics, Calif. Inst. of Tech.

A POINT FOCUSING MONOCHROMATOR FOR THE STUDY OF LOW-ANGLE X-RAY DIFFRACTION. DETERMINATIONS OF THE SIZE DISTRIBUTIONS OF CARBON BLACKS AND A PRECISION DETERMINATION OF THE SIZE OF DOW LATEX PARTICLES, by Leon Shenfil, Warren E. Danielson, and Jesse W. M. DuMond. Oct. 18, 1951. 91p. (NP-3763; Special Technical Report No. 15; U20031)

A point-focusing x-ray monochromator was designed and constructed for low-angle scattering studies. The anastigmatic point focus is achieved by means of 2 cylindrically bent quartz crystals whose focal circles are mutually perpendicular. The beam, emanating from the copper target of an x-ray tube, is reflected first from the crystal defining the horizontal focal circle and second from the crystal defining the vertical focal circle following which it comes to a monochromatic point focus of wave length 1.537 Å (Cu $K\alpha_1$). The sample to be studied is placed between the second crystal and the point focus, and the scattered beam is detected by means of a photographic plate placed at the point focus, at right angles to the undeviated beam, the latter being suppressed by means of an absorber. Mathematical analysis, in which a ray was traced through the 2-crystal system, revealed the shape and size of the point focus and the possibility of reducing the latter in size by stopping down the beam emerging from the target. Suggestions for improving the intensity of the instrument consist of (1) substitution of topaz crystals for quartz, (2) use of helium atmosphere instead of air to surround the x-ray beam, and (3) reorientation of the x-ray tube to permit smaller angles of emergence of the beam. In a trial run for the instrument, the scattering patterns of 2 kinds of carbon black were obtained from which the average particle sizes and size distributions were calculated. (auth)

3806

California Univ., Berkeley

CONCENTRATION POLARIZATION AND LIMITING CURRENTS; A CRITICAL REVIEW OF EXISTING THEORIES, by Morris Eisenberg, Charles W. Tobias, and Charles R. Wilke. Jan. 15, 1952. (NP-3806; Technical Report No. 1; U21894)

This work represents the first phase of a research program designed to study the role of ionic diffusion and mass transfer in electrode processes. The basic concepts of total electrode, concentration, and chemical polarizations are considered. The relationship between concentration polarization and the rate of mass transfer to or from electrodes is discussed. A detailed review and history of the development of theories for interpretation of diffusional convective effects upon polarization, limiting current, and related phenomena are presented. The correlations developed for mass and heat transfer for other fields of application are shown to be of value in the analysis of electrode phenomena. (auth)

3807

Atomic Energy Research Establishment, Harwell, Berks (England)

HIGH RESISTOR METER TYPE 1055B; FINAL MANUAL (A.E.R.E. Catalogue No. 3-7/7993). [nd] 38p. (NP-3835)

The meter referred to in this instruction manual is a line-operated megohm-meter suitable for the measurement of high-value resistors and insulation resistance by the drift method. The unknown is measured by timing the drift of the indicating meter to full-scale deflection; therefore, an external timing device, e.g., a stop watch, is required in addition to this instrument in order that a measurement of resistance may be made. An indication of resistance value can be obtained in a few seconds, but for greatest degree of accuracy it is necessary to time for about 100 seconds. A calibration chart is provided on the top of the instrument. (auth)

3808

Atomic Energy Research Establishment, Harwell, Berks (England)

C.R.O. MONITOR TYPE 1089B; INTERIM MANUAL (A.E.R.E. Catalogue No. 3-7/8079). [nd] 19p. (NP-3836)

A manual for the Cathode Ray Oscilloscope Monitor type 1089B is given. The instrument is intended primarily for monitoring the output of amplifiers in pulse-counting systems. It is also of use for the testing and maintenance of electronic equipment, although the scope of such work may be restricted by the limited facilities provided. The time base may be free running, or may be triggered from an external source provided this delivers suitable pulses. The signal input may be a-c or d-c coupled to the Y plates, and a metered Y shift circuit is provided for measuring a-c or d-c voltages. No Y plate amplifier is used, and the sensitivity is about 15 v/cm.

3809

Carnegie Inst. of Tech.

A MAGNETIC POTENTIAL DIVIDER, by George Hinman and Frank Crane. Dec. 15, 1951. 11p. (NYO-3299)

A type of magnetic potential divider for shaping the magnetic field near a pole edge is discussed. This method of terminating a pole has been applied to a β-ray spectroscope magnet recently constructed at Carnegie Institute of Technology. The operation is very satisfactory. (auth)

3810

RAPID X-RAY QUANTITATIVE ANALYSIS OF CRYSTALLINE POWDERS WITH PARTICULAR REFERENCE TO TITANIUM DIOXIDE PIGMENTS. W. Hughes and H. Smith. Analyst 77, 179-85(1952) Apr.

A simple x-ray diffraction camera is described, the action of which is based on the flat powder layer method. The camera can be constructed easily and it gives a tenfold reduction in exposure times compared with a normal 9-cm powder camera. Specimen preparation is simplified, and where large numbers of specimens are involved there is considerable saving of time in processing the film. The instrument has proved useful for very rapid qualitative and quantitative examinations of crystalline powders. The accuracy with rutile–anatase mixtures is about ±2.5%. A second method of quantitative analysis by means of a Geiger-counter x-ray spectrometer is described. No photographic processing is required and the accuracy with rutile–anatase mixtures is probably better than ±1%. (auth)

ISOTOPES

3811

Argonne National Lab.

OCCURRENCE OF THE 4n + 1 SERIES IN NATURE, by D. F. Peppard, G. W. Mason, P. R. Gray and J. F. Mech. Apr. 10, 1952. Decl. May 19, 1952. 14p. (AECD-3378; ANL-WMM-962)

A small quantity of Np^{237}, the long-lived ancestor of 4n + 1 series, has been isolated from a natural source. The Th^{229} content of Th^{230} obtained from Belgian Congo pitchblende concentrate and of Th^{232} obtained from Brazilian monazite has been determined indirectly through isolation of the Ac^{225} daughter. The mass ratio of Np^{237} to U^{238} in the Belgian Congo pitchblende concentrate has been determined as $1.8 \pm 0.4 \times 10^{-12}$. The mass ratio of U^{233} to U^{238} in the same ore deposit is found to be $1.3 \pm 0.2 \times 10^{-13}$. The ratio of the respective neutron-capture cross sections of U^{238} in the ore body for the (n,2n) and (n,γ) reactions is calculated to be $1.3 \pm 0.6 \times 10^{-3}$ on the basis of the relative Np^{237} and Pu^{239} contents. (auth)

3812

Massachusetts Inst. of Tech.

PHYSICAL, BIOLOGICAL, AND ADMINISTRATIVE PROBLEMS ASSOCIATED WITH THE TRANSPORTATION OF RADIOACTIVE SUBSTANCES; NUCLEAR SCIENCE SERIES PRELIMINARY REPORT NO. 11, by Robley D. Evans. 1951. 76p. (NP-3824; Preliminary Report No. 11)

Problems of packaging, handling, storage, and transportation of radioactive materials are discussed. Nuclear data and methods of calculating shielding requirements are presented which should be a useful guide to those responsible for the packaging and shipment of radioactive materials. Biological data compiled as a convenience to commercial producers and shippers of radioactive materials, whose legal departments request proof of the advisability of imposing upper limits on the surface radiation from finished parcels, and quantitative data on photographic materials useful to manufacturers, shippers, and users of photographic materials are included. The need is stressed for international regulations regarding the shipment of radioactive materials in order to provide smooth and uninterrupted international transportation. 156 references.

3813

TECHNIQUES OF NATURAL CARBON-14 DETERMINATION. J. Lawrence Kulp, Lansing E. Tryon, and Herbert W. Feely. Trans. Am. Geophys. Union 33, 183-92(1952) Apr.

The techniques which are in use at the Lamont Geological Observatory for the preparation and counting of the C^{14} in natural carbon-bearing samples are described in detail. The first phase of the process includes preparation of pure carbon dioxide by burning or hydrolysis, the reduction to carbon with hot magnesium, and the extraction of the product to remove all substances except the carbon. The yield is generally 90% of the carbon in the original sample with an ash content of about 1%. The carbon samples are mounted in a stainless-steel cylinder and counted against a background cylinder of stainless steel in a modified Libby screen-wall-type counter with an active counting length of eight inches and a diameter of three inches. This counter is surrounded with 30 by 2-inch cosmic-ray counters which are used in anticoincidence. The entire assembly is placed in a large shield with eight-inch-thick iron walls. The electronic unit contains two regulated high-voltage supplies, drag-in voltage, monitor selector switch, anticoincidence analyzer, scale of four, and register. This arrangement has provided background as low as 2.5 cpm with normal operation ranging from 4 to 6 cpm. The efficiency of the screen-wall counter is about 5%. With three days of counting, this arrangement can measure samples up to 25,000 years old for wood and 30,000 years for shells. Application of this quantitative method of age determination to a wide variety of samples of geological interest is in process. (auth)

ISOTOPE SEPARATION

3814

[Radiation Lab., Univ. of Calif.]

THE ISOTRON, by R. R. Wilson. [nd] Decl. May 19, 1952. 45p. (AECD-3373; UCRL-833)

A description is given of the principles and development of the isotron in which ions, drawn from a plane source by an electric field with discrete velocities corresponding to their masses and bunched by an r-f field, are diverted to collectors at the proper times. The following main headings appear: ion sources, production of large ion beams, the analyzer, the buncher, bunching ions, collection, and large-scale operation. The organization of the isotron project is briefly summarized in an appendix. 43 references, 12 figures.

3815

FRACTIONATION OF CARBON ISOTOPES BY ABSORPTION OF CARBON DIOXIDE. Peter Baertschi. Helv. Chim. Acta 35, 1030-6(1952) May 2. (In German)

A fractionation factor of 1.014 for $C^{12}O_2$ in relation to $C^{13}O_2$ was observed on absorption of a N_2-2.6% CO_2 gas stream by aqueous $Ba(OH)_2$ solution. When pure CO_2 was absorbed the factor was only 1.011. The relation of C isotope fractionation in plants to the mechanism of CO_2 assimilation is discussed.

MATHEMATICS

3816

MONTE CARLO STUDY OF SHOWER PRODUCTION.
Robert R. Wilson. Phys. Rev. 86, 261-9(1952) May 1.

Electron- and photon-initiated showers in lead have been calculated in a simple Monte Carlo manner for energies from 20 to 500 Mev. The results, exhibited in a series of transition curves, show considerable differences from the results of conventional cascade theory in that the number of electrons at the maximum are fewer and the shower is more penetrating. The effects of multiple coulomb scattering of the electrons have been included and depend markedly on the measurement considered. Thus, ionization currents are only slightly changed (the transition curves are foreshortened by about one-half radiation length) while the number of electrons counted behind lead plates in a cloud chamber can be reduced by as much as 50 percent by effects of multiple scattering. This result is nearly independent of the incident energy. The final curves obtained are compared with the ionization measurement of Blocker, Kenney, and Panofsky and the cloud-chamber measurements of A. M. Shapiro. The agreement is satisfactory. A simple quasi-analytic cascade theory is developed in which known low-energy solutions are used to obtain successively higher-energy solutions. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

3817

Brookhaven National Lab.
LITHIUM IODIDE NEUTRON DETECTOR, by A. W. Schardt and W. Bernstein. [nd] 47p. (BNL-1156)

In order to take advantage of the $Li^6(n,\alpha)H^3$ reaction in the detection of slow neutrons, crystals of thallium-activated LiI have been employed as scintillators. Details are given for the growing of the crystals, for the photomultiplier and counter circuit, and of the observed performance. Mixed NaI-LiI systems were tried but results are inconclusive. Activation of LiI with Ag, In, and Sn were also studied, in an attempt to obtain a more uniform distribution throughout the crystal, and results are reported.

3818

National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION; FOR THE QUARTER ENDING JUNE 30, 1951. 37p. (NBS-1080; U18947)

Progress is reported on the following projects: barium titanate and vacuum tube accelerometers, CRO beam intensification, design of corrugated diaphragms, electron interferometer, CO_2 hypsometer, pneumatic instruments, strain and displacement instruments, mass spectrometer for study of solids, magnetic effects on mechanical vibrations, electron beam magnetometer, microphonic study of microwave tubes, improved optical microscopes, new design for photomultiplier, pulsed photomultiplier, thickness gage, mutual-inductance and spring transducers, and absolute measurement of vibration amplitudes. The following projects were initiated: balances with "frictionless" bearings, acoustic viscometer for gases, ultrasonic velocimeter for gases and liquids, determination of temperature with the noise thermometer, medical-physics instrumentation, and anesthesia monitor. (cf. TIP U17283) (NRS abst.)

3819

Sarah Mellon Scaife Radiation Lab., Univ. of Pittsburgh
FAST NEUTRON SPECTROMETER PROJECT REPORT NO. 1; THE THEORY OF FAST NEUTRON COINCIDENCE SPECTROMETERS, by George E. Owen, John H. Neiler, and John C. Wheatley. June 1951. 53p. (NP-3802; Report No. 1; U18899)

An instrument is to be designed for detecting 0.2- to 20-Mev neutrons with reasonable efficiency and good resolution. Two spectrometer types are proposed for measuring the energy of fast incident neutrons by recoil-proton detection: (1) the proton-pulse-amplitude spectrometer which utilizes the scattering angle of the neutron (θ) and the energy of the recoil proton (E_p) to determine incident neutron energies and (2) the time-of-flight spectrometer which utilizes the scattering angle and the energy of the scattered neutron. The incident neutron energy (E_o) in the first method is calculated from $E_o = E_p/\sin^2\theta$. In the second method, the energy of the scattered neutron E_n is obtained from $E_n = ML_o^2/2T_d^2$, where M in the neutron mass, L_o the crystal separation, and T_d the time of flight measured with a fast delayed coincidence circuit. Resolution curves were plotted as functions of (1) E_o at 1 and 10 Mev., (2) θ, and (3) the time of flight from 1 to 10 mμsec. for L_o's of 1 and 4 in. Calculated and experimental counting rates were compared for a 1-in. cube of anthracene. Calculated and experimental curves showed a definite correlation.

3820

Atomic Energy Research Establishment, Harwell, Berks (England)
MONITOR RADIATION BETA-GAMMA PORTABLE 1043 D; INSTRUCTION MANUAL ISSUE. 1 (A.E.R.E. Catalogue No. 3-7/6824). [nd] 20p. (NP-3834)

The instruction manual for the portable β-γ radiation monitor type 1043D is given. The monitor is designed for making quick surveys of radiation hazards. It is self-contained and constructed in a form permitting easy handling and is similar to Monitor 1043C in all particulars except for the electrometer tube and circuit. The response time is about half that of the 1043C. A direct reading of γ-radiation intensity is given on a calibration meter.

3821

Atomic Energy Research Establishment, Harwell, Berks (England)
ALPHA ASSAY EQUIPMENT 1093.B; INSTRUCTION MANUAL ISSUE 1. [nd] 80p. (NP-3837)

Details of design and operating procedure for Alpha Assay Equipment 1093B are presented. The complete equipment consists of a scintillation counting unit, a power unit, and a multiplier photocell. The equipment is especially suitable for the measurement of activities of less than 100 disintegrations/min, and with the supplement of suitable scaling equipment, activities of up to 100,000 d/min can be measured. With suitably prepared samples a comparative accuracy of 1 to 2% is possible over the greater part of this range. The standard sample dish has an effective sample area of ~12 cm^2. Accurate α measurements can be made in the presence of β activities of up to ~10^9 d/min.

3822

Atomic Energy Research Establishment, Harwell, Berks (England)
DOSIMETERS INDIVIDUAL; QUARTZ FIBRE; NOS. 1, 2, AND 3; INSTRUCTION MANUAL ISSUE 1. [nd] 22p. (NP-3856)

The dosimeters referred to are about the size and shape of a fountain pen, in an Al case, and fitted with a spring clip so that they can be worn in a pocket. They are designed to measure and sum up any amounts of γ radiation to a total of 0.5 r for No. 1, 5 r for No. 2, and 50 r for No. 3. The total amount of radiation the instrument has received at any time since recharging is read by looking through it while holding it to the light. The instrument consists of three principle parts—the ionization chamber, the charging end, and the microscope.

3823

ABSOLUTE MEASUREMENT OF BETA ACTIVITIES AND APPLICATION TO THE DETERMINATION OF NEUTRON DENSITIES. René Cohen. Ann. phys. (12) 7, 185-237(1952) Mar.-Apr. (In French)

The problem of absolute measurement of radioactive sources is discussed in this doctoral thesis (Paris, Jan. 1951). Design and characteristics of a 4 π Geiger counter suitable for absolute measurement of β activities or neutron fluxes, accurate within 2%, and simple in construction are presented.

3824

A β-RAY SPECTROGRAPH WITH SYMMETRY PLANE AND DOUBLE FOCUSING OBTAINED BY AIR-CORE COILS. Andre Moussa and Jean-Baptiste Bellicard. Compt. rend. 234, 1681-3(1952) Apr. 21. (In French)

Distortion of the focusing field of a β-ray spectrograph by the presence of iron poles is avoided by using air-core electromagnets. Field strengths, radii, and ampere-turns are related for several arbitrary examples of coils permitting focusing of electrons with energies up to 1.3 Mev.

MESONS

3825

Rochester Univ.

PRODUCTION OF 40 MEV π^+ AND π^- MESONS IN SEVEN ELEMENTS BY 240 MEV PROTONS, by Donald L. Clark. May 5, 1952. 5p. (NYO-3050)

A measurement has been made of the relative differential cross section for production of 40-Mev π^+ mesons in the angular range 130 to 150° by 240-Mev protons in Be, C, Al, Cu, Ag, W, and Pb. A similar measurement has been made for 40-Mev π^- mesons in the angular range 30 to 50°. The measured relative cross sections are tabulated. The π^+ relative cross sections vary in about the same manner as the π^- relative cross sections, except for C and Al. There appears to be no simple correlation of the cross sections of the present experiment with the mass number.

3826

NUCLEAR PHENOMENA DEDUCIBLE FROM μ-PAIR THEORY WITH PSEUDOSCALAR COUPLING. L. M. Tannenwald. Phys. Rev. 86, 332-9(1952) May 1.

The case of pseudoscalar coupling between nucleons and μ field is considered within the framework of μ-pair theory. Besides the usual perturbation treatment, the strong coupling approximation for this case is developed. Both methods are applied to the problems of scattering of μ mesons by nucleons and the nucleon-nucleon interaction. Interpolation between the extremes of weak and strong coupling suggests that this μ-pair theory may be promising with an intermediate coupling strength, a condition also required by the μ-pair theory of the π meson.

METEOROLOGY

3827

Washington Univ.

ATMOSPHERIC TURBULENCE STUDY; ANNUAL PROGRESS REPORT; 1 AUGUST 1949 – 30 APRIL 1951, by Robert G. Fleagle and Franklin I. Badgley. Apr. 1951. 37p. (AECU-2023; Occasional Report No. 1)

Progress is reported in an investigation of the relationships between meteorological quantities and the rate of diffusion of matter in the lower atmosphere. Data are included from studies of the mean wind speed as a function of height, the effect of radiation from fog on the temperature distribution and the rate of diffusion, the dependence of eddy conductivity of temperature on height, the determination of the coefficient of eddy conductivity from mean data, and the photographic determination of the component velocities present in turbulent flow in the atmosphere. A schematic sketch of a setup for photographing air-borne particles is included.

3828

New York Univ. Coll. of Engineering

TURBULENCE STUDIES USEFUL IN WIND TUNNEL SIMULATION OF ATMOSPHERIC CONDITIONS; PROGRESS REPORT, METEOROLOGICAL PHASE, JULY 1, 1950 TO FEBRUARY 28, 1951, by Hans A. Panofsky and Irving A. Singer. Feb. 28, 1951. 75p. (NYO-4001)

Report is made of observations at BNL on the properties of turbluence in the free air as a means of aiding in the simulation of free-air conditions in the wind tunnel. Different methods for measuring exchange coefficients (Austausch coefficients) were tried for the eventual comparison of these coefficients for different properties. The method leading to the most reliable results consisted in the direct measurement of vertical flux of the various properties with the aid of a bivane. In addition, attempts were made to estimate exchange coefficients from the diurnal variation of temperature, and the variation of the mean wind with height. The spectral characteristics of turbulent properties are discussed. It was found both by theory and observation that, at 410 ft, the contribution of eddies with period of less than a minute to the vertical flux of momentum (stress) is relatively small, and that due to eddies with period <10 sec can probably be neglected entirely. Also, the flux due to periods of an hour or longer is probably relatively unimportant. For horizontal flux, the larger the eddies the more efficient they are. Most of the horizontal transport of momentum is carried by eddies of the size of cyclones. An instrument is described which will analyze the energy spectrum of turbulence electronically. The conditions for rapid changes of the turbulent characteristics were investigated. The critical Richardson number increases with height, and whereas it distinguishes between laminar and turbulent flow in a wind tunnel, it separates different states of turbulence in the atmosphere. Deacon's power law was fitted to the variation of mean wind with height in the lowest 125 meters. The law proves to be a good interpolation formula. Also, the power is related linearly to stability, with numerical value equal to the one in the neutral case. Fairly good estimates of the wind at 100 m could be made from the wind at 11.5 m and the stability of the air. The linear scale factor between atmosphere and the N.Y.U. wind tunnel was 7000. This should be reduced to 300 in order to permit Richardson numbers in the tunnel equal to those occurring in the atmosphere. (auth)

3829

New York Univ.

DEVELOPMENT OF CONTROLS FOR PRODUCTION OF TEMPERATURE AND VELOCITY GRADIENTS IN THE WIND TUNNEL; PROGRESS REPORT WIND TUNNEL PHASE, by J. A. Halitsky, C. P. Randell and M. Hackman. Apr. 9, 1951. 90p. (NYO-4002)

The design of the 3.5 × 7 ft wind tunnel as it now exists is described, and proposed revisions are discussed. The pilot tunnel, of cross section 10 × 20 in., is described and experiments which have been performed in it are summarized. Production of a linear velocity gradient by means of a series of screens of increasing height (effectively varying the solidity over the tunnel height) was proved successful in the pilot tunnel with velocity gradients varying from 3 to 12 fps/ft depending on the average tunnel speed. Tests of the velocity profile in the boundary layer of the 3.5 × 7 ft tunnel indicate that the profile is similar to the profile in the earth's boundary layer in an adiabatic atmosphere. Equipment for introducing a temperature gradient in the pilot tunnel by means of heated wires has been designed; a model of the wire support and tensioning arrangement has been found mechanically successful; and experiments on closely spaced tensioned heated wires in the large tunnel have shown that no sagging or vibration of the wires is experienced even at top operating speed of the tunnel. Heat transfer calculations are presented which show that linear temperature gradients of 6°F/ft can be produced at an average tunnel speed of 8 fps with the power supply presently available at the tunnel. For a linear

gradient of 6°F/ft in the 3.5 × 7 ft tunnel, the velocity gradients corresponding to Richardson numbers of 1 and 0.04 are 0.06 and 3 fps/ft, respectively.

NEUTRONS

3830

Los Alamos Scientific Lab.

TABLES OF FUNCTIONS ASSOCIATED WITH THE SERBER-WILSON METHOD FOR NEUTRON DIFFUSION CALCULATIONS IN A SPHERICAL GEOMETRY. VOLUME I, by Dura Sweeney, Max Goldstein and Bengt Carlson. May 1950. 80p. (LA-1364)

The quantities κ and φ tabulated are functions of a parameter f, $-1 \leq f \leq \infty$, the functional relations being transcendental equations. κ and φ are functions associated with the Serber-Wilson method for neutron diffusion calculations in a spherical geometry. (see NSA 6-3660, 6-3661 for continuation)

NUCLEAR PHYSICS

3831

RELATIVISTIC THEORY OF NUCLEAR FORCES. IV. CALCULATION OF THE NEUTRON-PROTON INTERACTION PRODUCED BY A PSEUDOSCALAR FIELD. Maurice Lévy. Compt. rend. 234, 1671-2(1952) Apr. 21. (In French)

The formalism previously developed by the author (Compt. rend. 234, 815, 922(1952); NSA 6-2738, 6-2739) is used to derive expressions for the interaction between neutron and proton produced by a symmetrically charged pseudoscalar meson field.

3832

NUCLEAR SPECTROSCOPY WITH HARMONIC OSCILLATOR WAVE-FUNCTIONS. Igal Talmi. Helv. Phys. Acta 25, 185-234(1952) Apr. 30. (In English)

Development of a new method (different from the usual Slater method) for calculation of the matrix elements for interaction of the outer nucleons in the shell model is made possible by limitation to harmonic central potentials. Noncentral forces can be treated simply. As examples, the order of levels in the j^n configuration, the doublet splitting arising from spin-orbit coupling, and configurations of the Li^7 nuclear levels are calculated.

3833

ELECTRODYNAMIC CORRECTIONS TO THE FINE STRUCTURE OF POSITRONIUM. Robert Karplus and Abraham Klein. Phys. Rev. 86, 257(1952) Apr. 15.

The separation of the ground-state doublet of positronium is considered from the theoretical point of view. Electrodynamic corrections due to the exchange of two virtual quanta and relativistic corrections to the first-order calculation are taken into account in predicting the 1^3S-1^1S separation to be 2.0337×10^5 Mc. This value is in satisfactory agreement with the measurements of Deutsch and Brown (Phys. Rev. 85, 1047(1952)).

NUCLEAR PROPERTIES

3834

Chicago Univ.

CAPTURE CROSS SECTION OF Si FOR THERMAL NEUTRONS, by J. H. Coon. May 6, 1942. Decl. with deletions May 5, 1952. 26p. (AECD-3375; C-107)

D-D neutrons, slowed down to approximately thermal energies by graphite, were allowed to diffuse into SiO_2 powder. Two types of neutron-density measurements in the SiO_2 were made. First, the neutron density at the center of a 16-in. cube of SiO_2 was compared to neutron densities at the center of similar cubes of powdered graphite-boron mixtures substituted in place of the SiO_2. These measurements gave $0.169 \pm 0.002 \times 10^{-24}$ cm^2 for the atomic capture cross section of Si, the determination being based on known capture cross sections for B, C, and O. Secondly, measurements of the neutron density distribution F were taken in a prism of the SiO_2 powder with the aim of using the diffusion equation $\nabla^2 F/F = 1/L^2$ to determine the diffusion length L. Two separate sets of distribution measurements, with two separate boundary conditions for the SiO_2 prism, gave $L = 31.1 \pm 0.5$ cm and 31.8 ± 0.5 cm, for an SiO_2 density of 1.382 g/cm^3. The capture cross section of Si corresponding to the average L value is calculated to be $0.150 \pm 0.007 \times 10^{-24}$ cm^2. The boron comparison measurements are thought to give the best value. The above ± values indicate with what precision a repetition of the same measurements would give the same results. (auth)

3835

EFFECT OF THE ATOMIC CORE ON THE MAGNETIC HYPERFINE STRUCTURE. R. Sternheimer. Phys. Rev. 86, 316-24(1952) May 1.

Equations have been obtained for the magnetic field at the nucleus due to the current induced in the electron core by an external valence electron. The magnetic field is written as $-4\mu_0[j/(j(j+1))]\langle r^{-3}\rangle_p(1+R_m)$, where $\langle r^{-3}\rangle_p$ is the average over the valence electron function, assumed in a p state, R_m is the correction due to the core, μ_0 = Bohr magneton, j = angular momentum. R_m is of importance in obtaining the nuclear quadrupole moment Q from the value of the magnetic moment μ_I and the ratio b/a of the splittings due to Q and μ_I. The electric field gradient at the nucleus, $-\frac{1}{2}e\langle r^{-3}\rangle_p(1+R)$, which determines b, contains a similar term R for the distortion of the core by the valence electron. It is shown that R_m approximately cancels the exchange terms of R, so that the correction factor for Q is that predicted by the Thomas-Fermi model. (auth)

3836

THE SIGN OF THE QUADRUPOLE INTERACTION ENERGY IN DIATOMIC MOLECULES. R. A. Logan, R. E. Coté, and P. Kusch. Phys. Rev. 86, 280-7(1952) May 1.

The molecular-beam magnetic-resonance method has been used to determine the sign (and the magnitude in those cases where it has not been previously measured) of the quadrupole interaction energy of the alkali nuclei in the homonuclear molecules, that of Na^{23} and Li^7 in the alkali halides, and that of Cl^{35} and Cl^{37} in KCl. An obstacle is inserted into the path of the beam so that its edge coincides with the position of the undeflected beam. Molecules of either positive or negative total magnetic moment are then removed from the beam which arrives at the detector. Certain maxima in the nuclear resonance spectrum at high magnetic fields ($eqQ \ll g_I\mu_0 H$) arising from the transitions $\Delta m_I = \pm 1$ are suppressed depending on the states removed by the obstacle. It is thus possible to identify the resonance maxima in terms of the transitions which produce them. From this evidence the sign of the quadrupole interaction energy can be deduced. The quadrupole interaction energy eqQ is positive for Li^7 and negative for Na^{23} in the homonuclear and the halide molecules. These results suggest that the sign of q at a given nucleus is the same in a rather considerable range of diatomic molecules. The interaction constant eqQ is positive for Cs^{133} in Cs_2, and negative for K^{39} in K_2, Rb^{85}, Rb^{87} in Rb_2, and Cl^{35}, Cl^{37} in KCl. The signs of the interaction for K^{39}, Rb^{85}, Rb^{87}, and Cs^{133} in the alkali fluorides, and for Cl^{35}, Cl^{37} in TlCl as determined by the molecular beam electrical resonance method are the same as those for the same nucleus in the molecules here considered. (auth)

3837

TRITON BINDING ENERGY BY A RANDOMIZED NET-POINT METHOD. S. I. Rubinow. Phys. Rev. 86, 388-90 (1952) May 1.

A numerical procedure is investigated for solving Schroedinger's equation for a system of particles. A net-point analysis is applied directly to the integral equation equivalent to Schroedinger's equation. A unique feature is the introduction of the concept of a "randomized" net of points. This is designed to cope with the problem of obtaining adequate covering of the space when many dimensions are involved. The method is applied to the problem of finding the binding energy of the triton with the assumption of central forces. The result obtained for an exponential potential as determined by the most recent low-energy scattering data is approximately 10 percent too deep. It may be concluded that more effective repulsion must be introduced into the "equivalent central potential" to bring about agreement with experiment. (auth)

3838

ATOMIC MASSES FROM TITANIUM THROUGH ZINC. Thomas L. Collins, Alfred O. Nier, and Walter H. Johnson, Jr. Phys. Rev. 86, 408-12(1952) May 1.

The double-focusing mass spectrometer previously described has been used to measure 27 atomic masses in the region from titanium to zinc. When supplemented by earlier values and nuclear reaction energies, the data give the masses of 81 nuclides between mass numbers 21 and 70. A fit of the semi-empirical mass formula of Wigner indicates the existence of magic numbers at 20 and 28 protons and neutrons associated with discontinuities in the binding energy surface. The discontinuities are primarily changes in slope of the surface. (auth)

3839

HYPERFINE STRUCTURE OF THE SPECTRA OF GADOLINIUM AND ZIRCONIUM. S. Suwa. Phys. Rev. 86, 247-8 (1952) Apr. 15.

The hyperfine structure of the Gd spectrum in the visible region was studied by means of a water-cooled hollow-cathode discharge tube (the cathode contained Gd oxide) and a Fabry-Pérot etalon. As to the isotope shift, the ratios $\Delta\nu(Gd^{157}-Gd^{160})/\Delta\nu(Gd^{158}-Gd^{160}) = 1.94 \pm 0.25$ and $\Delta\nu(Gd^{155}-Gd^{160})/\Delta\nu(Gd^{158}-Gd^{160}) = 2.71 \pm 0.02$, were determined from the structure of λ4401.8 and 4373.8. A rough estimate of the magnitudes of the magnetic moments of Gd^{157} and Gd^{155} is $|\mu(Gd^{157})| = 0.3 \pm 0.2$ n.m. and $|\mu(Gd^{155})| = 0.25 \pm 0.15$ n.m. In the study of the hyperfine structure of the spectrum of Zr I, the cathode contained powdered Zr and was cooled with liquid air. In some lines, shift of the components caused by the even isotopes Zr^{90}, Zr^{92}, and Zr^{94} was detected. The value of the magnetic moment of Zr^{91} was calculated to be -1.1 ± 0.3 n.m.

3840

$\beta-\gamma$ POLARIZATION CORRELATION IN Sb^{124}. Robert Stump. Phys. Rev. 86, 249(1952) Apr. 15.

The polarization correlation between the 2.29-Mev β particles and the succeeding 0.60-Mev γ rays in the decay of Sb^{124} has been measured by determining the rate of triple coincidences between the β particles, the γ rays, and the γ rays scattered from a large anthracene crystal in two scattering directions. From the ratio of the triple coincidence rates for the two scattering directions (perpendicular and parallel to the plane of the β and γ, with the angle between the β and γ always $\pi/2$) and a knowledge of the angular correlation coefficient, it is concluded that the γ transition occurs without a change in parity.

3841

SPECTROSCOPIC ISOTOPE SHIFT AND NUCLEAR SHELL STRUCTURE. G. Breit. Phys. Rev. 86, 254(1952) Apr. 15.

From a theoretical standpoint views of nuclear shell structure (NSS) present the difficulty of reconciliation of a one-body, individual-particle approach with the apparent existence of many particles within each other's range of force. It is speculatively considered whether the centrifugal barrier associated with high values of the azimuthal quantum number L contributes to the possibility of assigning the usual shell-structure quantum numbers as reasonably "good" quantum numbers. The considerations are based on empirical evidence from the spectroscopic isotope shift, which shows marked irregularities at the closure of nuclear neutron shells. A way of correlating the facts which appears adequate for explaining the apparent goodness of the NSS quantum numbers is as follows: (1) It is supposed that there exists a nuclear core and that for even Z the protons form a part of it. (2) The radius of the core is smaller than the radius of the maximum of $|r\phi|^2$ for the $1i_{13/2}$ neutrons when Z ~80 and the $1h_{11/2}$ neutrons when Z ~50. (3) Within the core the neutrons with higher L move somewhat as hypothesized by Weisskopf; outside the core neutrons move essentially as free particles. (4) The density of the core is approximately constant.

3842

jj-COUPLING IN NUCLEI. B. H. Flowers. Phys. Rev. 86, 254-5(1952) Apr. 15.

The splitting of the states of the nuclear configuration $(l_j)^n$ under the influence of central forces considered as a perturbation has been investigated. Group-theoretical methods were used to obtain the wave functions, properly antisymmetrized and classified as to seniority, for all the states of the configurations of 2, 3 and 4 particles of a given kind (neutron or proton) for $j = 3/2$, $5/2$, and $7/2$, and the relative positions of levels have been studied as a function of the range of the interaction. The calculations are not presented, but some of the consequences are discussed. It is questioned whether the conditions of jj-coupling are properly established in nuclei with masses $\lesssim 50$.

3843

MAGNETIC MOMENT OF Se^{77}. S. S. Dharmatti and H. E. Weaver, Jr. Phys. Rev. 86, 259(1952) Apr. 15.

The sign and value of the magnetic moment of Se^{77} were found by a nuclear-induction method to be $+ 0.53326 \pm 0.00005$. Resonances of Se^{77} with an amplitude ~70 times that of the random noise were detected in SeO_2 and H_2SeO_3 dissolved in water wtihout the addition of paramagnetic ions.

NUCLEAR REACTORS

3844

Oak Ridge National Lab.

A DETERMINATION OF THE DIFFUSION LENGTH OF THERMAL NEUTRONS IN THE X-10 STANDARD GRAPHITE PILE, by E. D. Klema, R. H. Ritchie and T. Arnette. [nd] Decl. May 19, 1952. 8p. (AECD-3384)

A mathematical analysis was performed to determine the diffusion length L of thermal neutrons in the X-10 standard graphite pile. Using a single Ra-Be neutron source the diffusion length was found to be 49.8 cm, while using a double source the corresponding value of L obtained was 49.9 cm.

NUCLEAR TRANSFORMATION

3845

Oak Ridge National Lab.

FISSION ASYMMETRY AS A FUNCTION OF EXCITATION ENERGY OF THE COMPOUND NUCLEUS, by J. L. Fowler, W. H. Jones and J. H. Paehler. [nd] Decl. May 19, 1952. 4p. (AECD-3374)

A preliminary investigation of asymmetry of fragment mass distribution from proton-induced fission has been made as a function of energy in the range 11 to 18 Mev. Foils of normal U separated by Al were bombarded at a fixed radius with the internal beam of the 86-in. cyclotron. For each U foil, the fission yields of Mo^{99} and Ag^{111} relative to Ba^{140} were determined by use of radiochemical procedures. Relative yields were obtained in terms of known yields by performing the identical radiochemical analysis for thermal-

neutron fission in similar quantities of normal U. The ratio yield Mo^{99}/yield Ba^{140} is almost constant as a function of proton energy and is ~60% higher than in the case of thermal-neutron fission in U^{235}. The ratio yield Ag^{111}/yield Ba^{140} varies with proton energy in such a way as to indicate that the probability of symmetrical fission increases rapidly with excitation energy. A graph comparing the asymmetry of fission produced in several ways shows that the symmetrical mode of fission requires ~4.7 Mev more energy than the asymmetrical mode.

3846

Los Alamos Scientific Lab.

ENERGY DISTRIBUTIONS OF FRAGMENTS FROM THE FISSION OF U^{235}, U^{238}, AND Pu^{239} BY FAST NEUTRONS (thesis), by John S. Wahl. Los Alamos Scientific Lab. and Iowa State Univ. [nd] Decl. Apr. 29, 1952. 90p. (AECD-3379; LADC-1143)

The energies of fragments from fission of U^{235}, U^{238}, and Pu^{239} by 14-Mev neutrons, from fission of U^{238} by 2.5-Mev neutrons, and from fission of U^{235} and Pu^{239} by thermal neutrons have been measured in a Frisch grid ionization chamber. The energy distributions for fast-neutron fission show the same two peaks familiar from previous measurements on fragments from fission by thermal neutrons. The most probable energies of the light and heavy fragments from fissions induced by 14-Mev neutrons change only slightly (~1 Mev) from their values for slow-neutron-induced fission. The most important change in the shapes of the spectra is an increase in the height of the valley between the two peaks. This rise is interpreted as indicating increased probability of symmetrical fission. The energy distribution of pairs of fragments from fission of U^{235} by 14-Mev neutrons has been measured in a double "back-to-back" Frisch grid ionization chamber. The main change in the distribution of fission modes from that for thermal-neutron fission is the increased probability, by a factor of 100, for symmetrical fission. (auth)

3847

EVIDENCE FOR THE REACTION $Zn^{64}(n,\alpha)Ni^{61}$ INCITED BY SLOW NEUTRONS. Henriette Faraggi and René Bernas. Compt. rend. 234, 1684-6(1952) Apr. 21. (In French)

Zn enriched to 95% in Zn^{64} was irradiated with thermal neutrons while in contact with nuclear emulsion. Tracks of α particles of ~7-Mev energy were observed in a concentration indicating a cross section for the $Zn^{64}(n,\alpha)Ni^{61}$ reaction of $\sim 1.5 \times 10^{-29}$ cm^2.

3848

SHORT-RANGE PROTONS FROM THE DEUTERON BOMBARDMENT OF Li^6. R. W. Gelinas and S. S. Hanna. Phys. Rev. 86, 253-4(1952) Apr. 15.

Thin targets of natural Li, evaporated onto Ni foils, were bombarded with 0.91- and 1.03-Mev deuterons, and the $Li^6(d,p)Li^7$ reaction products corresponding to an excitation energy of 4.30 to 4.80 Mev in Li^7 were observed at 90 and 110°. Nitrogen-contaminated targets were also exposed to eliminate the possibility that the proton groups observed were due to the $N^{14}(d,p)N^{15}$ reaction. An average value Q = 0.410 ± 0.015 Mev was obtained for the Li reaction, and an excitation energy in Li^7 of 4.610 ± 0.020 was established. A value of Q = 0.296 ± 0.015 Mev was obtained for the N group. Explanations are suggested for the shape of the rather high continuous proton background.

3849

THE MASS DIFFERENCE Mg^{23}—Na^{23}. H. B. Willard, J. D. Kington, and J. K. Bair. Phys. Rev. 86, 259-60(1952) Apr. 15.

The threshold for the $Na^{23}(p,n)Mg^{23}$ reaction has been measured as 5.091 ± 0.010 Mev, the Q value then being −4.88 Mev. By taking the n-H^1 mass difference to be 0.782 Mev, the Mg^{23}—Na^{23} mass difference was found to be 0.0044_0 amu.

3850

THE PHOTODISINTEGRATION OF THE DEUTERON AT INTERMEDIATE ENERGIES. I. C. A. Barnes, J. H. Carver, G. H. Stafford, and D. H. Wilkinson. Phys. Rev. 86, 359-72 (1952) May 1.

Measurements have been made of the absolute cross section for photodisintegration of the deuteron at six gamma-ray energies in a range where the photomagnetic effect is small compared with the photoelectric. The methods of determining the gamma-ray flux are described as are the high-pressure deuterium-filled ionization chamber and proportional counter used to determine the disintegration rate. The results are given in the following table, together with the reactions used to provide the gamma-rays.

Reaction	Gamma-ray energy (Mev)	Cross section (10^{-28} cm^2)
$N^{15}(p,\alpha)C^{12*}$	4.45 ± 0.04	24.3 ± 1.7
$F^{19}(p,\alpha)O^{16*}$	6.14 ± 0.01	21.9 ± 1.0
$Be^9(p,\gamma)B^{10}$	7.39 ± 0.15	18.4 ± 1.5
$C^{13}(p,\gamma)N^{14}$	8.14 ± 0.08	18.0 ± 1.3
$B^{11}(p,\gamma)C^{12*}$	12.50 ± 0.21	10.4 ± 1.0
$Li^7(p,\gamma)Be^8$	17.6 ± 0.2	7.7 ± 0.9 (auth)

3851

THE PHOTODISINTEGRATION OF THE DEUTERON AT INTERMEDIATE ENERGIES. II. D. H. Wilkinson. Phys. Rev. 86, 373-6(1952) May 1.

The measurements of Barnes, Carver, Stafford, and Wilkinson (Phys. Rev. 86, 359(1952)) on the absolute cross section for photodisintegration of the deuteron in the range of gamma-ray energy from 4.45 to 17.6 Mev are analyzed. The cross sections for the electric dipole disintegration from the ^3S state are obtained by subtracting small computed magnetic dipole and ^3D-state contributions. The electric-dipole cross sections are analyzed from the point of view of both square-well and Yukawa-type interactions and yield the following effective ranges (in units of 10^{-13} cm):

Effective range	Square well	Yukawa well
$\rho_t(-\epsilon, -\epsilon)$	1.73	1.79
$\rho_t(0, -\epsilon)$	1.75	1.70
$\rho_t(0,0)$	1.77	1.62

The probable error in $\rho_t(-\epsilon, -\epsilon)$ is $\pm 0.09 \times 10^{-13}$ cm. ^3P-state forces have been neglected. The meson mass associated with the Yukawa well is 291 ± 24 electron masses. (auth)

3852

PHOTODISINTEGRATION OF THE DEUTERON. V. E. Krohn, Jr., and E. F. Shrader. Phys. Rev. 86, 391-5(1952) May 1.

The angular distribution of the protons from the $d(\gamma,n)p$ reaction has been investigated for 5 to 13-Mev gamma rays by means of the D_2O loaded emulsion technique with the Case betatron serving as gamma-ray source. The results have been compared to a differential cross section of the form $d\sigma = \{a + (b + c\cos\theta)\sin^2\theta\}d\Omega$ in the center-of-mass system and the isotropy coefficient found consistent with the mean values: a/b = 0.04 ± 0.03 from 5 to 11 Mev and 0.24 ± 0.07 from 11 to 13 Mev. The forward asymmetry coefficient was determined for energies above 8 Mev and found to be c/b = 0.24 ± 0.09. These results are in agreement with the theoretical calculations of Marshall and Guth except for the isotropy coefficient observed above 11 Mev where the theory predicts a/b~0.01. (auth)

3853

THE YIELD OF F^{18} FROM MEDIUM AND HEAVY ELEMENTS WITH 420-MEV PROTONS. Luis Marquez. Phys. Rev. 86, 405-7(1952) May 1.

The yield of F^{18} from medium and heavy elements, when bombarded with 420-Mev protons, was determined. Chemical procedures and techniques are described and the cross sec-

tions varying from 2.2×10^{-2} barn for F to 4.4×10^{-6} for Au are given. Comparisons are made of these results with those of other heavy fragments obtained under similar conditions. (auth)

PARTICLE ACCELERATORS

3854

Purdue Univ.

BASIC RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON; REPORT ON PROGRESS JULY 1, 1951 TO FEBRUARY 15, 1952. [nd] 40p. (AECU-2036)

The progress made in the synchrotron construction, adjustments, tests, and components is reported. Detailed reports are given on the operation and adjustments of the magnets, design of the vacuum tube and vacuum system, and the r-f resonator studies. Other research projects briefly mentioned are the development of research equipment, i.e., cloud chamber, electronic circuits, and photographic emulsions; and cosmic ray investigations and scattering problems.

3855

Engineering Research Inst., Univ. of Mich.

FINAL REPORT, UNIVERSITY OF MICHIGAN CYCLOTRON, by W. C. Parkinson and H. R. Crane. Feb. 1952. 26p. (AECU-2037)

The engineering items necessary in the rebuilding of the Univ. of Michigan 42-in. cyclotron are described. The cyclotron is now operating with larger internal and external beams than at any time in its history and is now arranged so that it makes available for research 5-Mev protons, 10-Mev deuterons, and 20-Mev α particles.

RADIATION ABSORPTION AND SCATTERING

3856

Los Alamos Scientific Lab.

THE SCATTERING OF 10-MEV DEUTERONS BY H^3 AND He^3, by A. H. Armstrong, J. C. Allred, A. M. Hudson, R. M. Potter, E. S. Robinson, L. Rosen, and E. J. Stovall, Jr. [nd] 5p. (AECU-2024; LADC-1119)

The differential cross sections for 10-Mev deuterons scattered by H^3 and by He^3 have been determined at 43 angles between 29° and 140° (c.m. system). A multiplate camera was used; 162,000 tracks were counted. The identity of the cross sections above 50° for this set of mirror interactions is consistent with present evidence for the equality of n-n and p-p forces. Below 50° the two curves diverge, to an extent which can be attributed to the increased coulomb scattering by He^3. There is considerable evidence of deuteron disintegration in both interactions.

3857

Massachusetts Inst. of Tech.

EFFECT OF A LOW ABSORPTION COEFFICIENT ON X-RAY SPECTROMETER MEASUREMENTS, by D. T. Keating and B. E. Warren. Mar. 31, 1952. 13p. (NYO-766)

In x-ray spectrometer measurements with a flat sample, low absorption produces an asymmetric broadening and displacement of the measured peak. The distortion of the peak due to low absorption can be corrected by an expression involving only the measured peak shape and its derivative. The distortion can also be corrected by the Stokes method of Fourier analysis, and values of the coefficients are given for a suitable range of experimental conditions. (auth)

3858

Rochester Univ.

LIMITATIONS ON MASS CHANGES IN PROTON-PROTON SCATTERING AT 240 MEV, by C. L. Oxley. Apr. 28, 1952. 3p. (NYO-3206)

Breit (Phys. Rev. 84, 1053(1951)) has recently discussed the production of an isomeric proton state in p-p scattering and its possible influence on high energy scattering by allowing ^3S scattering to occur. Breit and Jones (Phys. Rev. 84, 1054(1951)) have suggested the detection of small isomeric excitation energies by their influence on the angle between the two protons emitted in scattering. The data of Towler (Phys. Rev. 85, 1024(1952) and unpublished Thesis, Univ. of Rochester, 1951) from an experiment in which the scattered protons were detected in photographic plates after deflection in the cyclotron field may be used to set a limit on allowable mass changes. The entrance angle in the photographic plate (Towler's λ) is sensitive to inelasticity in the scattering. Towler's results have been examined for this purpose. The measured λ's agree to better than one degree except for 171° scattering in which a deviation of ~3 degrees is observed. Since the agreement may be fortuitous the r.m.s. effective uncertainty in λ has been conservatively estimated considering uncertainties due to geometry, incident energy (4%), field variations and inhomogeneity, and distribution in λ. The assumption is made that a large part of the scattering involves isomeric excitation as Breit suggests. The position of the center of the p-p peak in the observed distribution in λ is the value to be compared with the one predicted for elastic scattering. For that value of λ the following limits on the mass have been estimated from the listed effective uncertainty in λ.

Center of Mass Scattering Angle	108	143	152	153	161	167	171
$\Delta\lambda$ (degrees)	.95	1.02	.89	1.94	2.79	5.75	10.5
Allowed Δmc^2(Mev)	9.8	2.96	1.85	3.08	2.87	3.79	4.62

These estimates have been made for simplified proton geometry in which the paths were assumed to lie in the median plane of the cyclotron gap. The slight dip downward should introduce no noteworthy change in these estimates. The values of allowable mass change in the table are those derived for detection of the unexcited proton. If the heavier isomer is detected these estimates would be reduced by 12%. We may conclude that a mass change in excess of 3 Mev is incompatible with Towler's data provided the mass change is produced in most of the scatterings. If the isomeric excitation is not dominant larger mass change for small fraction of the scattering processes would be allowed by Towler's date. (Entire report)

3859

COMPARATIVE MODELS IN NUCLEAR SCATTERING. D. C. Peaslee. Phys. Rev. 86, 269-71(1952) May 1.

The "optical" and "compound" methods for treating nucleon-nucleus encounters are compared on the basis of a very simple model. It is concluded that the optical procedure is valid for incident energies E>~80 Mev, the compound for E<~30 Mev. The statistical model of the excited nucleus can be applied only when the excitation energies of individual nucleons may all be considered to be within the lower limit. For π mesons incident on nuclei similar considerations show that the optical method must be used under all circumstances. (auth)

3860

THE SCATTERING OF NEUTRONS BY SYSTEMS OF HEAVY NUCLEI. G. Placzek. Phys. Rev. 86, 377-88(1952) May 1.

It is shown that the scattering of neutrons by a system of heavy nuclei may, for neutron energies that are large compared with the level separation of the system, be described in terms of averages of simple two-particle operators over the initial state. Expressions are derived for the total and differential cross sections and for the first few moments of the energy transfer. The expression for the cross section can be explicitly evaluated even for complicated scattering systems and leads to an accurate representation of the energy dependence of the nuclear scattering. The results are

applied to the problem of the detection of small electronic contributions to the cross section. (auth)

3861

NEUTRON-PROTON SCATTERING WITH SPIN-ORBIT COUPLING. I. GENERAL EXPRESSIONS. John M. Blatt and L. C. Biedenharn. Phys. Rev. 86, 399-404(1952) May 1.

Neutron-proton scattering in the triplet spin state is discussed under the following assumptions about the nuclear forces: (1) the forces are conservative, (2) they allow time-reversal, i.e., the reciprocity law is valid, (3) the spin vectors of the neutron and proton enter in a symmetrical way, so that the total spin of the system is preserved during the collision, and (4) the forces have a finite range. We do not assume that the forces can be derived from a potential function (i.e., that they are velocity-independent). General expressions are given for the scattering matrix and for the differential cross section. The matrix elements of the scattering matrix are expressed in terms of the minimum numbers of real, independent parameters. The energy dependence of these parameters near zero energy can be predicted uniquely on the basis of assumptions (1) to (4) above. (auth)

3862

SINGLE SCATTERING OF FAST ELECTRONS AT LARGE ANGLES. W. Paul and H. Reich. Z. Physik 131, 326-30 (1952). (In German)

The dependence of single scattering of 2.2-Mev electrons at 60, 90, and 120° on the nuclear charge of the scattering substance (polystyrene, Al, Cu, Ag, Sn, or Pt) was investigated. The scattering cross section for heavy elements was smaller than expected from the Mott-Feshbach theory. The angular dependence of scattering intensity for light elements agreed with theory within experimental error.

3863

RANGE OF FAST ELECTRONS. O. Blunck. Z. Physik 131, 354-75(1952). (In German)

The range distribution function of fast electrons in material of arbitrary Z was investigated theoretically for the cases of incident electron energy small and large with respect to the rest energy mc^2. A simple analytical expression was found for the mean range. Good agreement was obtained with the experimental data of Williams (Proc. Roy. Soc. (London) A130, 310(1931)) on 20-kev electrons in O_2. As examples, the ranges of 1- to 3000-Mev electrons in Pb and O_2 are calculated and discussed.

3864

QUANTIZATION OF THE RADIATION PROCESSES IN THE NUCLEAR DROP. W. Jekeli. Z. Physik 131, 481-7(1952). (In German)

It is shown that quantization of the incompressible nuclear drop model can be carried out analogously to quantization of the spherically symmetrical radiation field. Calculation of the matrix elements from the interaction energy between matter and field leads to angular momentum conservation and transition probabilities for emission and absorption.

RADIATION EFFECTS

3865

ON THE RANGE-ENERGY RELATION AND IONIZATION-ENERGY RELATION FOR ALPHA-PARTICLES IN AIR. Kiichi Kimura, Ryutaro Ishiwari, Kazunori Yuasa, Sukeaki Yamashita, Kozo Miyake, and Sadao Kimura. J. Phys. Soc. Japan 7, 111-13(1952) Jan.-Feb.

An ionization chamber 1 mm deep was used to measure the specific ionization of Po α particles in air, and the effect of columnar recombination was examined by varying the field strength. The front window of the chamber was covered with Al foil 0.41 mg/cm^2 thick. The ratio of the specific ionizations at two definite points on the ionization curve were measured by applying the chamber voltages 50, 135, and 1140 ν/mm. The whole specific ionization curve with applied voltage 50 and 1140 ν/mm was measured; the integrated curve nearly agreeing with the fixed points determined from nuclear reactions.

RADIOACTIVITY

3866

Carbide and Carbon Chemicals Co. (K-25)

THE SPECIFIC ALPHA-ACTIVITY OF URANIUM 234, by C. A. Kienberger. Issued Apr. 30, 1952. Decl. May 19, 1952. 6p. (AECD-3377; K-878)

The specific α activity of U^{234} has been redetermined, by α-counting uranium containing 94.7% by weight of U^{234}, in a 50% geometry ion chamber. The specific activity so determined is $1.347 \pm 0.004 \times 10^7$ disintegrations/min/mg of U^{234}, corresponding to a half life of $2.520 \pm 0.008 \times 10^5$ yr. The precision is expressed at the 95% probability level.

3867

Columbia Univ.

INVESTIGATION OF THE BETA SPECTRA OF Be^{10}, K^{40}, Tc^{99} AND Cl^{36}, by L. Feldman and C. S. Wu. May 9, 1952. 45p. (CU-108)

The beta spectra of Be^{10}, K^{40}, Tc^{99} and Cl^{36} were investigated with the Columbia University solenoidal spectrometer and it was found that each exhibited a forbidden shape. An analysis of the spectra yields the following results. The spectrum of Be^{10} for which $\Delta J = 3$, can be explained equally well by 2T or 2A for no parity change and by 3T or 3V if the parity does change. Similarly the spectrum of K^{40} for which $\Delta J = 4$ can be accounted for by 3T or 3A if the parity changes and by 4T or 4V for no parity change. $\Delta J = 2$ for the decays of both Tc^{99} and Cl^{36}. These spectra can be explained only by 2T or 2V with values for K^2 of 45 for Tc^{99} and 18 for Cl^{36} ($k^2 = |A_{ij}|^2/|T_{ij}|^2$). If the true interaction prevailing in beta decay is but a single one of the five linearly independent interactions, then it follows from these spectrum analyses that it must be the tensor interaction. A linear combination of tensor with one or more of the other interactions is possible. It seems, however, that more information than is provided by spectrum studies alone is necessary to determine the exact form of such a linear combination. (auth)

3868

Carnegie Inst. of Tech.

INTERNAL CONVERSION IN Cu^{64} AND Fe^{59}, by D. Brower, George W. Hinman, G. Lang, R. Leamer and D. Rose. Apr. 14, 1952. 6p. (NYO-3301)

Measurements of the K-conversion coefficients of the 1.34 Mev γ ray of Ni^{64} in the decay of Cu^{64} and the 1.11-Mev and 1.30-Mev γ rays of Co^{59} in the decay of Fe^{59} have been made by means of the β-ray spectroscope recently constructed at Carnegie Institute of Technology. In all cases the coefficient was obtained by measuring the ratio of the number of conversion electrons to the number of β rays in a component of the continuous spectrum. This value was divided by the number of γ rays per β ray as found from a decay scheme. The results were as follows: 1.34-Mev γ of Ni^{64}, $\alpha_K = (1.0 \text{ to } 1.6) \times 10^{-4}$; 1.11-Mev γ of Co^{59}, $\alpha_K = 1.45 \pm 0.5 \times 10^{-4}$; and 1.30-Mev γ of Co^{59} $\alpha_K = 0.84 \pm 0.05 \times 10^{-4}$.

3869

RADIATIONS FROM Ne^{19} AND Na^{21}. G. Schrank and J. R. Richardson. Phys. Rev. 86, 248(1952) Apr. 15.

The half lives, β spectra, and accompanying γ rays have been measured for the positron emitters Ne^{19} and Na^{21} with a 180° β-ray spectrometer and a NaI crystal γ-ray spectrometer. Ne^{19} and Na^{21} exhibited half lives of 18.5 ± 0.5 sec and 22.8 ± 0.5 sec, respectively, while the allowed Kurie plots gave end points of 2.18 ± 0.03 Mev and 2.50 ± 0.03 Mev, respectively. No γ line was detected above 0.51 Mev for either Ne^{19} or Na^{21}.

3870

EVIDENCE FOR K-SHELL IONIZATION ACCOMPANYING THE ALPHA-DECAY OF Po^{210}. W. C. Barber and R. H. Helm. Phys. Rev. 86, 275-80(1952) May 1.

The radiations of Po^{210} have been studied using NaI scintillation counters. It is concluded that the soft electromagnetic component probably entirely consists of x rays of lead. The region from 25 kev to 2.5 Mev has been examined and, with the exception of the known γ ray of 800 kev, no nuclear γ rays were observed. The ratio of the number of K x rays to the number of 800-kev γ rays was measured as 0.134 ± 0.025 to 1. The K-shell internal-conversion coefficient of the 800-kev transition has been reported as about 0.05, and hence the K x-ray intensity is too great to be explained by internal conversion alone. The residual x rays are attributed to the process whereby the emission of the alpha particle causes ionization of the atom. Comparison of the relative intensity of K x rays and alpha particles shows qualitative agreement with the probability of this ionization process as calculated by Migdal. (auth)

3871

RADIOISOTOPES OF BROMINE. S. C. Fultz and M. L. Pool. Phys. Rev. 86, 347-50(1952) May 1.

Selenium metal enriched with Se^{76} was bombarded with 7.3-Mev protons. A new 17.2-hour activity in bromine was observed and is assigned to Br^{76}. The radiations of Br^{83}, Br^{80}, Br^{77}, Br^{76}, and Br^{75} have been examined by use of a 180° focusing spectrometer and coincidence methods. Br^{83} emits a simple negatron spectrum with a maximum energy of of 0.94 ± 0.02 Mev. The ground state of Br^{80} emits a complex negatron spectrum with components: 1.97 ± 0.03 Mev (80 percent), 1.1 Mev (11 percent), 0.7 Mev (9 percent). The gamma rays of Br^{77} are associated with the K-capture process. The ground state of Br^{76} emits positrons having a complex spectrum with components 3.57 ± 0.07 Mev (46 percent), 1.7 Mev (10 percent), 1.1 Mev (11 percent), 0.8 Mev (14 percent), 0.6 Mev (19 percent). Gamma rays identified with Br^{76} have energies of 0.25, 0.33, 0.37, 0.42, 0.68, 0.75, 0.96, and 1.2 Mev. The ground state of Br^{75} decays by emission of positrons having a complex spectrum with components 1.70 ± 0.02 Mev (46 percent), 0.8 Mev (20 percent), 0.6 Mev (15 percent), 0.3 Mev (19 percent). (auth)

3872

ELECTRON SPECTRA BETWEEN 1 AND 10 KEV. H. Schneider, O. Huber, F. Humbel, A. de Shalit, and W. Zünti. Helv. Phys. Acta 25, 259-78(1952) Apr. 30. (In German)

The spectrum of low-energy (1 to 10 kev) electrons has been measured for the cases of Ag^{107}, Ag^{109}, Tc^{99}, Hg^{197}, Au^{195}, Au^{199}, and Au^{198} using a coincidence technique in which the electrons are accelerated in a lens spectrometer. The apparatus is described, and the results are compared with the predictions of the single-particle shell model. (auth)

3873

ON THE DECAY OF SOME ODD ISOTOPES OF Pt, Au AND Hg. A. de Shalit, O. Huber, and H. Schneider. Helv. Phys. Acta 25, 279-306(1952) Apr. 30. (In English)

Decay shemes and conversion coefficients for Pt^{195m}, Au^{195}, and Au^{199} were determined with a coincidence arrangement in a β-ray spectrometer. The results are discussed in relation to the shell model of the nucleus, and it is concluded that all excited states of these nuclides, as well as of Hg^{197}, are compatible with Mayer's single-particle model.

SHIELDING

3874

Brookhaven National Lab.

MECHANICAL FEATURES OF THE BROOKHAVEN SHIELDING FACILITY, by A. C. Rand, Jr. Dec. 1, 1951. 24p. (BNL-139)

The mechanical design of the shielding facility at Brookhaven National Laboratory reactor is reported. The facility is broken up into several major components and the design, special problems, and testing of each are described. A schematic diagram and photographs are included. (auth)

SPECTROSCOPY

3875

Oak Ridge National Lab.

MULTIPLE-CRYSTAL GAMMA-RAY SPECTROMETER, by F. C. Maienschein. Issued Apr. 14, 1952. 47p. (ORNL-1142)

A multiple-crystal spectrometer has been constructed for measuring gamma-ray spectra of interest in shielding work. This instrument makes use of NaI-Tll crystals, 5819 photomultipliers, and electronic pulse-height selectors. It utilizes either the Compton effect or pair production to provide a unique energy response. The sensitivity and resolution are quite adequate for shielding measurements. The sensitivity has been calibrated absolutely by comparison with a standard ionization chamber. Several spectra from radioactive sources have been included in this report as examples of the type of results that may be obtained. (auth)

3876

A NEW "DOUBLE RESONANCE" METHOD FOR INVESTIGATING ATOMIC ENERGY LEVELS. APPLICATION TO Hg $^3P_1$. Jean Brossel and Francis Bitter. Phys. Rev. 86, 308-16(1952) May 1.

Excitation of atoms in a vapor by polarized light produces unequal population of the magnetic sublevels of the excited state. The emitted optical resonance radiation is therefore partly polarized. The application of radiofrequency or microwave fields at a magnetic resonance frequency will induce transitions between sublevels of the excited state. The degree of polarization of the emitted optical resonance radiation is altered when the magnetic resonance condition is fulfilled. As suggested by Brossel and Kastler, this effect may be used to reveal the structure of the energy level. A detailed theory applicable to, and experiments on the $^3P_1$ state of all the isotopes of mercury are reported. The results obtained indicate that double resonance phenomena constitute a valuable new tool for investigating the structure of atomic energy levels. The mean life of the $^3P_1$ state is shown by observations on the resonance line widths to be 1.55 ± 10^{-7} sec for all the isotopes. The g-factor of the $^3P_1$ state for isotopes with zero spin, measured in terms of the proton g-factor, is 1.4838 ± 0.0004. (auth)

THEORETICAL PHYSICS

3877

Nuclear Physics Lab., Case Inst. of Tech.

SOME NOTES ON THE ELECTRON-NEUTRON INTERACTIONS, by L. L. Foldy. [nd] 12p. (AECU-2028; Technical Report No. 15)

The known electromagnetic properties of nucleons, assuming that the electron-neutron interaction is fundamentally of electromagnetic origin, are fitted into the phenomenological framework developed in the preceding paper (AECU-2027) and the results are compared with predictions of weak-coupling meson theories. The detailed comparison shows that the intrinsic electron-neutron interaction is somewhat smaller than predicted, and it is suggested that even in the more favorable cases, the rough agreement as to order of magnitude may be largely due to a fortuitous cancellation of different contributions, which may easily be upset when higher-order effects are included in the theory. Even apart from the detailed calculations, it is indicated that the ob-

served intrinsic electron-neutron interaction is considerably smaller than order-of-magnitude expectations from general meson-theoretical principles. The results emphasize the importance of more accurate experimental determinations of the electron-neutron interaction, since a smaller value of the intrinsic interaction will either pose a very stringent test for any meson theory or require a critical reevaluation of our present ideas regarding nucleonic structure. Some phenomena related to the electron-neutron interaction and the possibility that the intrinsic interaction may be non-electromagnetic in origin are briefly discussed. (auth)

3878

THE SECOND-QUANTIZED THEORY OF SPIN-½ PARTICLES IN THE NONRELATIVISTIC LIMIT. Richard K. Osborne. Phys. Rev. 86, 340-7(1952) May 1.

This is an abridged version of AECU-1662, which was abstracted in Nuclear Science Abstracts as NSA 5-6916.

3879

COVARIANT THEORY OF RADIATION DAMPING. Jean Pirenne. Phys. Rev. 86, 395-8(1952) May 1.

Schwinger's expression of the S matrix in the Cayley form, in terms of a hermitian operator K, is shown to be identical with the previous noncovariant expression used in Heitler's theory of radiation damping. The comparison of the two formalisms leads, furthermore, to a clear understanding of mass renormalization which is necessary for internal consistency, quite independently of the eventual removal of divergences. For the computation of $\overline{K}$ in a covariant way, new formulas generalizing and connecting Gupta's and Fukuda and Miyazima's results are presented. The nth order approximations of $\overline{K}$ and S are closely related, and $\overline{K}_n$ may be expressed in terms of the S_p of order $p \leq n$ or in terms of their anti-hermitian parts only. (auth)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 6B, page "SUPPLEMENT 1".

$_3Li^6_3$

Level	$Be^9(p,\alpha\gamma)Li^6$
3.58	
No other γ	$\alpha\gamma$ scin

R. B. Day, R. L. Walker, Phys. Rev. 85, 582(1952).

$_5B^{10}_5$

Resonance	σ_β	Γ(kev)
2.565	0.11	39

$Be^9(p,\alpha\gamma)Li^6$

R. B. Day, R. L. Walker, Phys. Rev. 85, 582(1952).

$_8O^{16}_8$

γ	$F^{19}(p,\alpha)O^{16}$
6.13 E3	polarization

A. P. French, J. O. Newton, Phys. Rev. 85, 1041(1952).

$_9F^{19}_{10}$

$F^{19}(p,\alpha)O^{16}$

Even parity for ground state

A. P. French, J. O. Newton, Phys. Rev. 85, 1041(1952).

$_{12}Mg^{24}_{12}$

Level	Mg(p,p)
6.38	a

C. J. Baker et al., Phys. Rev. 85, 1051 (1952).

$_{12}Mg^{25}_{13}$

$Mg^{24}(d,p)$

Level	Rel. Intensity	
0	20	
0.58	20	
0.94	15	
1.62	10	ppl

J. Ambrosen, Nature 169, 408(1952). $E_d = 1.9$

$_{12}Mg^{26}_{14}$

$Mg^{25}(d,p)$

Level	Rel. Intensity	
0	1	
1.84	4	
3.00	7	
4.00	10	
4.41	15	
4.91	10	ppl

J. Ambrosen, Nature 169, 408(1952). $E_d = 1.9$

$_{12}Mg^{27}_{15}$

$Mg^{26}(d,p)$

Level	Rel. Intensity	
0	35	
0.98	15	ppl

J. Ambrosen, Nature 169, 408(1952). $E_d = 1.9$

$_{13}Al^{25}_{12}$

Mg(p,p)

Levels	J	Γ(kev)
3.11	$p_{3/2}$	1.5
3.75	f	0.3
3.88	$p_{1/2}$	36
3.91	d	0.1
4.25	d	0.15
4.63	d	0.3
5.34	$p_{3/2}$	200
5.83	d ?	- -

L. J. Koester, Phys. Rev. 85, 643(1952). Theoretical interpretation of data of Mooring et al., Phys. Rev. 84, 703 (1951).

$_{13}Al^{27}_{14}$

Levels			Al(p,p)
0.99	3.00	4.39	a
1.72	3.63	4.66	
2.22	3.93	5.46	

C. J. Baker et al., Phys. Rev. 85, 1051 (1952).

$_{15}P^{32}_{17}$

Levels	P(n,γ)
20 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{16}S^{32}_{17}$

μ	0.63	Mic

J. R. Eshbach et al., Phys. Rev. 85, 532 (1952).

Levels	S(n,γ)
15 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{17}Cl^{36}_{19}$

Levels	Cl(n,γ)
12 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{19}K^{40?}_{21}$

Levels	K(n,γ)
7 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{19}K^{42?}_{23}$

Levels	K(n,γ)
5 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{20}Ca^{41?}_{21}$

Levels	Ca(n,γ)
7 capture γ's	pair s

B. B. Kinsey et al., Phys. Rev. 85, 1012 (1952).

$_{25}Mn^{54}_{29}$

$Cr^{53}(p,n)$

271 peaks

$E_p = 1.42 - 2.47$

J. A. Lovington et al., Phys. Rev. 85, 585 (1952); 83, 213A (1951).

$_{25}Mn^{55}_{30}$

$Cr^{54}(p,n)$

56 peaks

$E_p = 2.2 - 2.47$

J. A. Lovington et al., Phys. Rev. 85, 585 (1952); 83, 213A (1951).

$_{44}Ru^{105}_{61}$

β^-	1.15	sπ
γ	0.13	sπ;ce$^-$

C. L. Scoville et al., Phys. Rev. 85, 1046 (1952). Ru(10-Mev d).

$_{45}Rh^{99}_{54}$

τ	4.5^h	
β^+	0.74	sπ
No γ		

C. L. Scoville et al., Phys. Rev. 85, 1046 (1952). Ru(6.3-Mev p).

$_{45}Rh^{101}_{56}$	τ	4.5^d		C. L. Scoville et al., Phys. Rev. 85, 1046 (1952). Ru(p).
	γ	0.15	sπ;ce$^-$	
		0.30		
$_{45}Rh^{106}_{60}$ 36^h	β^-	0.57	sπ	C. L. Scoville et al., Phys. Rev. 85, 1046 (1952). Ru(10-Mev d).
$_{54}Xe^{129}_{75}$ 8^d	γ_1	0.040	sl;Lce$^-$	S. Thulin, I. Bergström, Phys. Rev. 85, 1055(1952).
	Crossover not found			
$_{62}Sm^{145}_{83}$	0.242 and 0.95 γ's due to impurity, probably Eu			R. Katz, M. R. Lee, Phys. Rev. 85, 1038 (1952).
$_{63}Eu^{152}_{89}$ 5.3^y	γ	0.121	sπ;ce$^-$	R. Katz, M. R. Lee, Phys. Rev. 85, 1038 (1952).
		0.244		
		0.344		
		0.990	a	
$_{63}Eu^{154}_{91}$ 5.4^y	γ	0.122	sπ;ce$^-$	R. Katz, M. R. Lee, Phys. Rev. 85, 1038 (1952).
		1.17	a	

(Q's Between Ground States)

$Cr^{53}(p,n)Mn^{53}$	-1.380 ± 0.008	J. A. Lovington et al., Phys. Rev. 85, 585.
$Cr^{54}(p,n)Mn^{54}$	-2.162 ± 0.005	J. A. Lovington et al., Phys. Rev. 85, 585.

Packing Fraction Differences, Δf, in Units 10^{-4} amu

Doublet	Δf	Reference
$Fe^{58}-Th^{232}$	-13.17 ± 0.05	G. S. Stanford et al., Phys. Rev. 85, 1039(1952).
$Co^{59}-Sn^{118}$	-2.99 ± 0.02	
$Pd^{104}-Pb^{208}$	-8.06 ± 0.02	
$Sn^{116}-Th^{232}$	-10.06 ± 0.03	
$Sn^{117}-U^{234}$	-10.01 ± 0.03	
$Sn^{118}-Co^{59}$	$+2.99 \pm 0.02$	
$Sn^{119}-U^{238}$	-10.19 ± 0.03	
$Ba^{138}-Pb^{207}$	-5.62 ± 0.05	
$Pb^{207}-Ba^{138}$	$+5.62 \pm 0.05$	
$Pb^{208}-Pd^{104}$	$+8.06 \pm 0.02$	
$Th^{232}-Fe^{58}$	$+13.17 \pm 0.05$	
$Th^{232}-Sn^{116}$	$+10.06 \pm 0.03$	
$U^{234}-Sn^{117}$	$+10.01 \pm 0.03$	
$U^{238}-Sn^{119}$	$+10.19 \pm 0.03$	

Mass Values–Time of Flight Measurements

Atom	Mass	Reference
S^{32}	31.983 ± 0.001	E. E. Hays et al., Phys. Rev. 84, 824(1951); 85, 1065(1952).
Cl^{35}	34.9805 ± 0.0005	
K^{41}	40.975 ± 0.002	
Br^{79}	78.944 ± 0.001	
Br^{81}	80.943 ± 0.001	
Kr^{84}	83.938 ± 0.001	
Rb^{85}	84.931 ± 0.002	
Rb^{87}	86.930 ± 0.002	
I^{127}	126.946 ± 0.001	
Xe^{129}	128.946 ± 0.002	
Xe^{130}	129.945 ± 0.002	
Xe^{131}	130.944 ± 0.002	
Xe^{132}	131.945 ± 0.002	
Xe^{134}	133.947 ± 0.002	

AEC, Oak Ridge, Tenn.-W15925